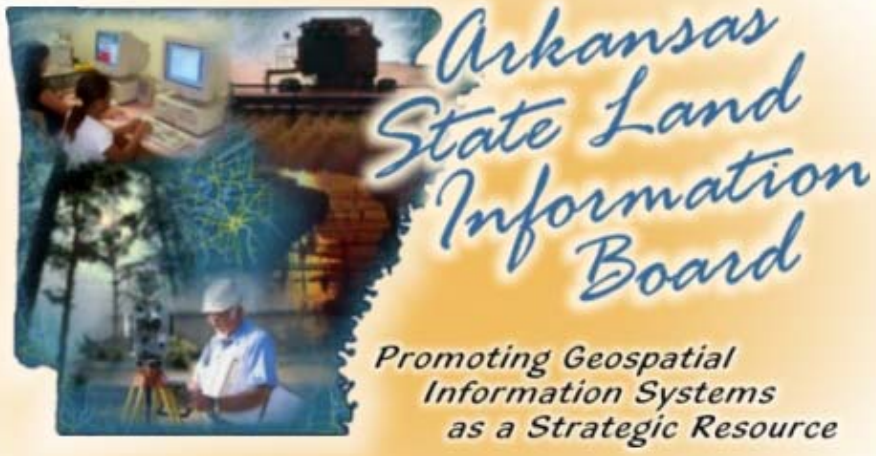
Arkansas
I-Team Plan



Compiled by the Arkansas Geographic Information Office
WWW.GIS.STATE.AR.US/ AGIO/Iteams/Iteam.htm

Submitted August 30, 2002

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Note: Each section is hyperlinked

1.0 Jurisdiction

The Arkansas State Land Information Board (AASLIB) was established by Arkansas Code 15-21-503. The ASLIB is composed of twelve Governor Appointees (*Appendix I*) representing state government, city, county and local government, the private sector and institutions of higher education. The ASLIB supports economic development and an improved quality of life for Arkansas citizens by providing basic spatial data infrastructure, coordinating geographic information activities, and creating short and long-term strategies that will result in improved decision making, effective asset management, and reduced costs. The ASLIB is recognized by the Federal Geographic Data Committee (FGDC) as the coordinating council for Geospatial Information Systems for the State of Arkansas.

The ASLIB's duties are outlined in Arkansas Code 15-21-503, and include:
1) Identifying issues, problems, and solutions in implementing the Arkansas spatial data infrastructure;
2) Identifying and clarifying the roles of participants;
3) Developing an overall coordinating schedule for spatial projects;
4) Recommending methods of financing;
5) Developing recommended priorities for the distribution of funds;
6) Developing procedures for the inventory, storage, and distribution of spatial information;
7) Implementing ongoing educational programs to promote understanding and productive use of spatial and land information systems by public and private entities and individuals;
8) Encouraging and coordinating collaborative GIS projects.

Arkansas Code 15-21-503 created the Arkansas Geographic Information Office (AGIO) in 2001. The AGIO (*Appendix II*) is responsible for carrying out the daily activities of the ASLIB and reports directly to the Arkansas Executive Chief Information Officer. On November 28, 2001 the ASLIB deemed fifteen spatial data layers critical to the Arkansas I-Team plan. The ASLIB established a subcommittee to focus on each of the fifteen spatial data layers. Each subcommittee is composed of professionals that pose a thorough knowledge about the spatial data layer.

The AGIO was tasked with compiling the reports from each of the subcommittees and presenting the Arkansas I-Team plan to the ASLIB on January 9, 2002. The Arkansas I-Team subcommittees will continue to meet through 2002 and refine each of their spatial data layer sections.

2.0 Cooperating Organizations and Contact Information

(Full listing available in Appendix III)

Arkansas State Land Information Board
Suzanne Wiley- GIS Specialist
wiley@uamont.edu

Arkansas Geographic Information Office
Shelby Johnson- GIS Coordinator
shelby.johnson@mail.state.ar.us

Cadastral Chairperson
Shirley Sandlin- Benton County, AR Assessor
ssandlin@co.benton.state.ar.us

Census Chairperson
Phyllis Smith- Assistant Director of the Arkansas State Data Center
pnsmith@ualr.edu

Centerline Chairperson
Christine Crawford- AR One Call GIS Specialist
ccrawford@arkonecall.com

Critical Infrastructure Chairperson
Susan Cromwell- IT Director of Fayetteville, AR School District
scromwell@fayar.net

Elevation Chairperson
Tony Hill- GIS Coordinator, United States Army Corps. of Engineers \ Little Rock District
tony.hill@swl02.usace.army.mil

Geodetic Control
Dr. Mike Garner- Director of Geospatial Information System, University of Arkansas - Fort Smith, Fort Smith, Arkansas College Fort Smith, AR
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Geology Chairperson
Doug Hanson- GIS Specialist, AR Geologic Commission
doug.hanson@mail.state.ar.us

Government Units Chairperson
Tim Humphries- General Council, Arkansas Secretary of State
tchumphries@sosmail.state.ar.us

Hydrography Chairperson
Dr. Paul Medley- Assistant Professor of Spatial Information Systems and GIS, University of Arkansas at Monticello
medley@uamont.edu

Land Use / Land Cover Chairperson
Tracy Ford Moy- GIS Coordinator, Arkansas Game and Fish Commission
tford@agfc.state.ar.us

Digital Orthophotography Chairperson
Earl Smith- Chief of Water Resources Management Division, Arkansas Soil and Water Conservation Commission
earl.smith@mail.state.ar.us

PLSS Chairperson
Mickie Warwick- President, Arkansas Society of Professional Surveyors
warwick@mail.cswnet.com

Soils Chairperson
Pam Cooper- GIS Specialist, United States
Natural Resources Conservation Service
pam.cooper@ar.usda.gov

Transportation Chairpersons

Dorothy Rhodes- Advanced Research Study Engineer, Arkansas Highway and Transportation Department

Bryan Stewart- Computer Technical Coordinator, Arkansas Highway and Transportation Department

3.0 Brief Description of Burning Issues

4.0 Brief overview or Summary of Framework activities

4.1 Digital Orthophotography

The Arkansas State Land Information Board began the Arkansas Digital Ortho Program (ADOP) in January of 2000. The project resulted in statewide one-meter resolution, color-infrared, digital ortho quarter quadrangles (DOQQ's). The DOQQ's were created with photography flown to National Aerial Photography Program (NAPP) and National Digital Ortho Program (NDOP) specifications.

ADOP was coordinated through the AGIO and funded through the support of a number of cooperators throughout Arkansas including: The Office of the Governor, Economic Development Fund of Arkansas, Arkansas Game and Fish Commission, Baxter County Arkansas, Benton County Arkansas, Crawford County Arkansas, Sebastian County Arkansas, International Paper, Plum Creek Timber Company, Weyerhaeuser, The Ross Foundation, United States Army Corps of Engineers - Little Rock District, United States National Forest Service and the United States Geologic Survey.

The second-generation DOQQ's will serve as base spatial data layer. The status of the project can be tracked via www.gis.state.ar.us/AGIO/adop.

4.2 Arkansas Centerline File

Spatial data layers are often stored digitally and accessed through a relational database management system (RDBMS). Although the centerline file is a component of the Arkansas Spatial Data Infrastructure, the way in which entities format and maintain it can differ. People often disagree on the way a particular spatial data layer structure should be organized. This can pose problems in terms of sharing, locating and extracting spatial data information. It is intended that this project will benefit the Geographic Information Systems (GIS) user communities in numerous ways, including but not limited to; *The National Map Program*, *The TIGER Modernization Program*, E-911 applications, routing services, and location dependant services. This project will result in a statewide seamless Arkansas Centerline File with a horizontal accuracy better than 10 meters and address ranges that are shareable to multiple end-users. The project status can be reviewed via http://www.gis.state.ar.us/AGIO/Iteams/ACF/ACF.htm.

4.3 Arkansas Geological Map

Thirty 7.5' topographic maps completed, five 7.5' maps in progress, 1:500,000 Arkansas Geological Map in progress, and one hundred seventy seven 7.5 quadrangles in the Ouachita Mountain region are ready for digitizing.

4.4 Arkansas Land Use Land Cover

Statewide data sets are complete for the period prior to 1999. Updated land use/land cover data is required on a periodic basis. Projected requirements are ten-year cycles for general land cover and forestry, five-year cycles for agriculture and more frequent but variable for local land use as local requirements will define land use needs. Rapidly growing areas of the state, e.g. Central Arkansas and Northwest Arkansas will require more frequent updates.

4.5 Arkansas SSURGO

Fifteen counties in Arkansas have digital soils layers SSURGO certified by the Natural Resources Conservation Service (NRCS); nine counties are in the final stages of NRCS certification. Forty-one counties have been digitized and are waiting on quality reviews and certification. Seventeen counties have little or no work completed.

4.6 Arkansas School District Boundaries

The project will result in the State of Arkansas having a geographic information system spatial data layer depicting updated school district boundaries and attributes in a standardized format. The estimated horizontal accuracy will be 10 meters.

5.0 Federal Champion

6.0 Financial Team Liaison

7.0 Clearinghouse Status and Contact Person

7.1 CLEARINGHOUSE

GeoStor is a statewide solution to the challenge of effectively delivering spatial data to geographically dispersed citizens, government and the private sector. The architecture of GeoStor is grounded in the philosophy of "Create once, distribute many..." and was designed on principles established by the Open GIS Consortium. GeoStor revolutionizes Arkansas' spatial data delivery by making spatial data for any area available at any time, in any file format and geographic projection the user chooses, with no subscription fee. From a state perspective GeoStor truly shifts the spatial data delivery paradigm making spatial data easily accessible, usable, and ultimately engaged to solve the complex problems faced while balancing the desire for development, management, and analysis. The GeoStor Technical Objectives can be viewed at http://www.gis.state.ar.us/Downloads/SLIC/pdf/asdi.pdf

7.2 CONTACT PERSONS

Dr. Fred Limp
Director of the Center for
Advanced Spatial Technologies
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Shelby Johnson
AR Geographic Information Systems
Coordinator
501-682-2767
shelby.johnson@mail.state.ar.us

8.0 Priority Themes

The Arkansas State Land information Board has determined the following framework data layers are a high priority: centerlines, public land survey system, cadastral, elevation.

9.0 Current Budget Summary

10.0 Budgeted Commitments to Date

11.0 Expected or Estimated Future Commitments Over the next Five Years

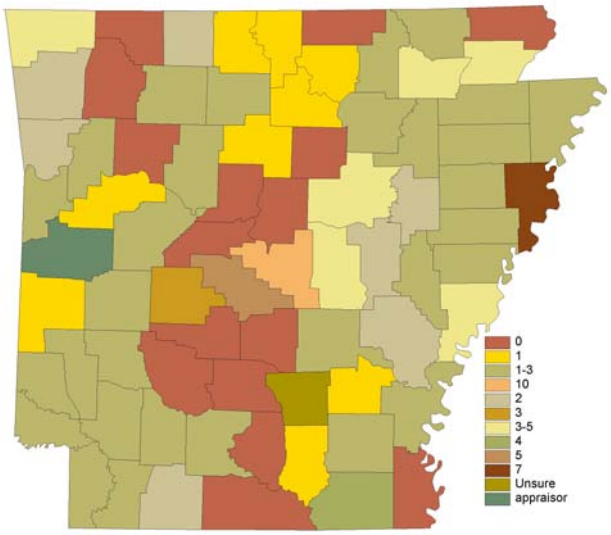
12.0 Fifteen Spatial Data Layers Critical to Arkansas

12.1 Theme: CADASTRAL

Cadastral data is under the supervision of the Arkansas county assessor offices, individual counties are responsible for tracking data of all property within their boundaries. Cadastral data is tracked by section, township and range, school districts, city limits, urban and rural property.

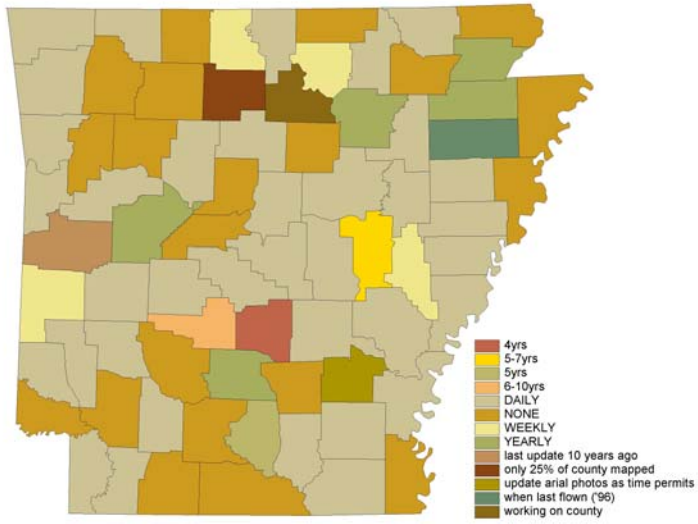
Status: The AGIO conducted a ten-question survey of all 75 Arkansas counties. The results enabled the cadastral subcommittee to determine the status of cadastral mapping in Arkansas. The questions were as follows:

1. How many employees in your office are dedicated to mapping?



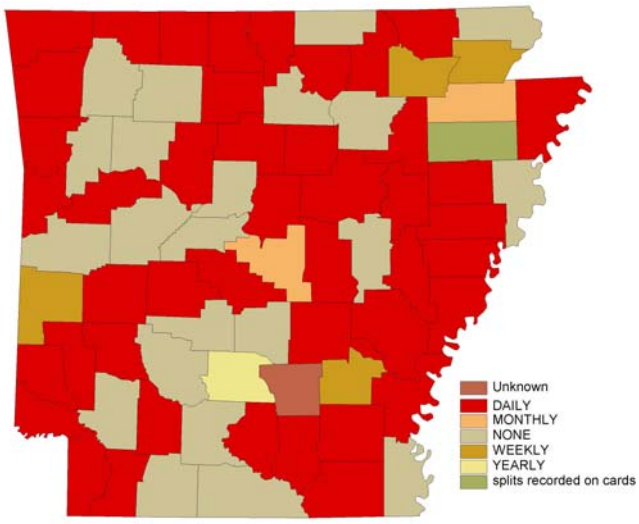
Answer: In most cases 3 employees or less were dedicated to mapping

2. How often do you update your maps? (hardcopies)



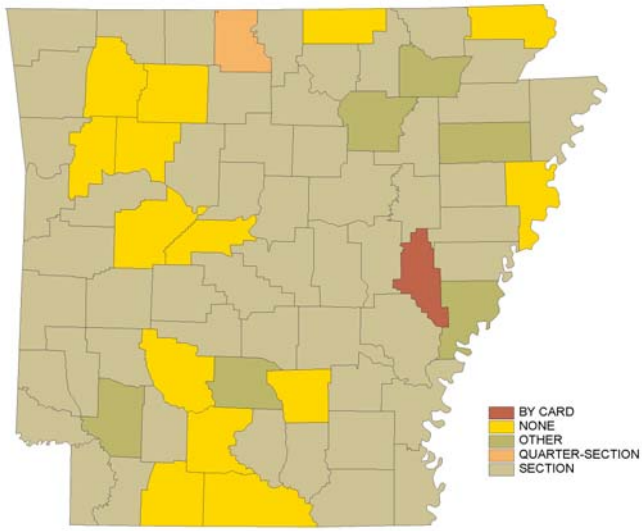
Answer: 21 counties do not map at all

3. Do you map splits as they occur?



Answer: 54 said yes

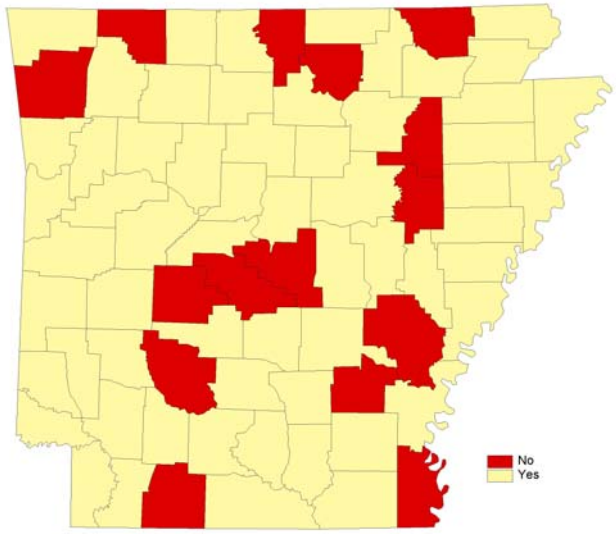
4. Map Tile



Answer: Generally 8.5x11 represents 1 section

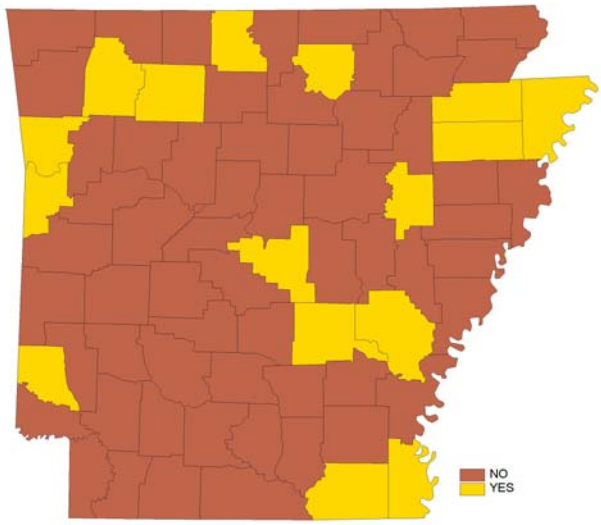
5. What is your map scale?
Answer: Varied, generally mapped at 1:660 this makes sense because of the aerials that were used as reference.

6. Do you use a plat book mapping company?



Answer: 20 counties did not or were not sure.

7. Do you enter the complete legal description into your CAMA?



Answer: 16 answered yes

8. Are all parcels in your CAMA?
Answer: 71 counties answered yes

9. Which CAMA do you use?
Answer: 38 use Assessor Apprentice
34 Arkansas CAMA Technologies

10. Are you interested in GIS?
Answer: 45% are interested but money is a limiting factor.

Cadastral Spatial Data Layers Available on GeoStor:

Source: Center for Advanced Spatial Technologies

Land Management- GAP 100k	Land Ownership- GAP 100k

Source: United States Geological Survey

Military Areas - GNIS 100k	National Forest or Grasslands- DLG 100k
National Parks- DLG 100k	National Wildlife Refuges- DLG 100k
Parks- GNIS 100k	Large Parks- DLG 100k
State Forest or Grasslands- DLG 100k	State Parks- DLG 100k
State Reservations- DLG 100k	State Wildlife Refuges- DLG 100k

Source: Bureau of Transportation Statistics

Military Bases- 100k	National Park Boundaries- 100k

Source: Most of the cadastral base maps were developed utilizing original surveys of section, township / range, and/or state plane coordinate system.

Standards: The only standards being followed are found in International Association of Assessing Officers (IAAO) workshop 651 GIS for Assessors. This subcommittee will review the implementation of statewide cadastral standards for the development of cadastral spatial data.

Priority: The Public Land Survey System (PLSS) needs to be updated with known coordinates. Parcel boundaries need to be digitally mapped in all 75 counties. Training and funding need to be put in place. Sources with spatial data available need to be discovered and evaluated.

Estimated total investment in this theme: Unknown at this time.
Estimated current state and local contributions: Unknown at this time.

What is needed? Training, funding and research to determine the availability spatial data.

What is a likely source? Arkansas Assessment Coordination, Arkansas Geographic Information Office and/or Eastern States Cadastral Initiative.

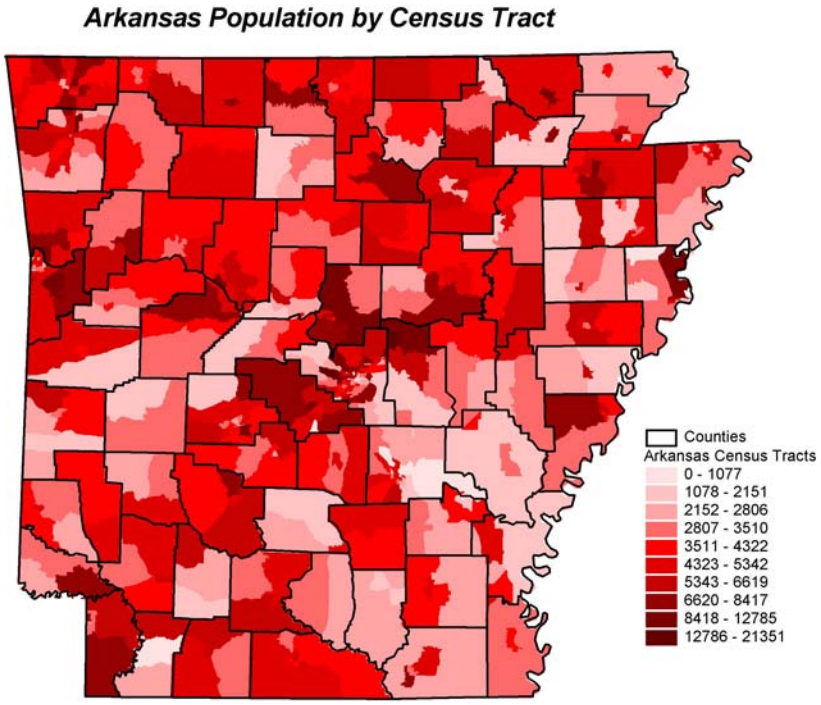
Estimated total investment to complete this theme? $20,165,000

Estimated current allocations of funding? Unknown at this time.
Possible ways to overcome this gap? Unknown at this time.

Most appropriate data steward: Arkansas County Assessor's

Maintenance: Unknown at this time.
Estimated maintenance cost: Unknown at this time.

12.2 Theme: CENSUS / DEMOGRAPHICS



The Bureau of the Census' mission is to collect and provide timely, relevant, and quality data about the people and economy of the United States. It accomplishes this task by taking a census every ten years and conducting surveys between census years. In 1990 the Census Bureau, in cooperation with the U.S. Geological Survey, developed a geographic database for the U. S. and its possessions. This product was the **T**opologically **I**ntegrated **G**eographic **E**ncoding **R**eferencing system (**TIGER**). Modernization of this system is ongoing. This theme will be comprised of the boundaries in the TIGER system, the demographic data collected by the Census Bureau, and population estimates and projections.

Status: The last decennial census was conducted April 1, 2000. Data compiled from questions asked of every household are presently available. Population items include sex, age, race, Hispanic or Latino, household relationship, and group quarters. Housing items include occupancy status, vacancy status, and tenure (owner occupied or renter occupied). Sample data collected from one in every sixth household will be available in 2002. Data from previous censuses are archived.

Census Spatial Data Layers Available on GeoStor:

Source: United States Bureau of the Census- TIGER

Census Block Groups 1990 (1998)
Census Block Groups 1990 (1999)
Census Block Groups 2000 (1999)
Census Block Groups 2000 (2000)
Census Block Points 2000
Census Block Groups 1990 (1998)
Census Blocks 1990 (1999)
Census Blocks 2000 (1999)
Census Blocks 2000 (2000)
Census Tracts 1998
Census Tracts 1990 (1998)
Census Tracts 1990 (1999)
Census Tracts 2000

Source: The Census State Data Center is a cooperative project of the U.S. Bureau of the Census and the State of Arkansas. The designated lead agency is located in the Institute for Economic Advancement, College of Business Administration, and University of Arkansas at Little Rock.

There are 25 affiliate centers in Arkansas representing 12 regional libraries, the eight Planning and Development Districts and five Regional Planning Councils.

The Demographic Research Division, Institute for Economic Advancement, is the state's representative in the Federal State Cooperatives for Population Estimates and Projections programs with the Census Bureau.

Standards: Federal Geographic Data Committee metadata standards are used to document TIGER spatial data.

Priority: Dissemination of census data and population projections. This is done through the work of the Census State Data Center and the Demographic Research Division. The Census State Data Center maintains a website and produce publications to distribute these data.

Estimated total investment in this theme: The Census State Data Center is funded by state appropriations totaling $150,000.

The UALR Geographic Information Systems Laboratory provides technical assistance in the redistricting and changing of geopolitical boundaries. It sends updates of boundary changes to the Census Bureau for incorporation into the TIGER system.

Estimated current state and local contributions: The United States Bureau of the Census, which is funded by federal monies, is responsible for taking the census and producing population estimates and projections. The Census State Data Center and Demographic Research are both funded by state appropriations. Each of the state agencies are responsible for dissemination of the census data, producing estimates and projections, and providing technical assistance in the use of the data. These two departments have been in these federal cooperative programs for over twenty years.

What is needed? The University of Arkansas at Little Rock Geographic Information Systems Laboratory receives no direct appropriations from the state. The work done with the Census Bureau is a non-funded function. Full time staff devoted to TIGER modernization would immensely improve the files for Arkansas.

What is a likely source? Unknown at this time.
Estimated total investment to complete this theme? Unknown at this time.
Estimated current allocations of funding? Unknown at this time.

Possible ways to overcome this gap? The Bureau of the Census, which is funded by federal monies, is responsible for taking the census and producing population estimates and projections. The Census State Data Center and Demographic Research, both funded by state appropriations, are the state agencies responsible for dissemination of the census data, producing estimates and projections, and providing technical assistance in the use of the data. These two departments have been in these federal cooperative programs for over twenty years.

The UALR GIS Laboratory receives no direct appropriations from the state. The work they do with the Census Bureau is not a funded function. Full time staff devoted to TIGER modernization would immensely improve the files for Arkansas.

Most appropriate data steward: The Census State Data Center

Maintenance: $150,000

Estimated maintenance cost: Unknown at this time.

12.3 Theme: Critical Infrastructure

Arkansans and United States citizens depend on a complex system of critical infrastructures to assure the delivery of vital services. The federal Office of Critical Infrastructure Assurance will provide guidance as we research our efforts to develop this I-Team subcommittee. Critical infrastructures comprise those industries, institutions, and distribution networks and systems that provide a continual flow of the goods and services essential to the nation's defense and economic security and to the health, welfare, and safety of its citizens. Readiness, reliability, and continuity of these inter-related infrastructure services depend on a coordinated approach to identifying the geospatial components of and references to these resources. The Arkansas Spatial Data Initiative will participate with all available partners and sharable resources to support the development of the critical infrastructures and telecommunications frameworks according to emerging I-Team standards. Due to inherent sensitivity of critical infrastructure data, strict security will be adhered to in the development of this framework layer.

Status:

- Information and communications – Project MAIN (Mapping Arkansas's Information Network) is an initial step in the development of the communications networks that bridge all of our government and educational facilities. We will need to update this database to make it current and solicit partnerships with Arkansas' telecommunications industries.
- Electric power generation, transmission, and distribution – In addition to our partners in the electrical community, this I-Team subcommittee will need to recruit help from the state's Public Service Commission as well as other private sector parties.
- Oil and gas production and distribution – Same as above.
- Banking and finance – New partnerships will need to be created here.
- Transportation – Will work closely with the Transportation I-Team subcommittee to ensure coordination.
- Water supply – Will work closely with the Arkansas Hydrology I-Team subcommittee to ensure coordination.

Emergency government services – Will work closely with the Arkansas Government Units I-Team subcommittee to ensure coordination.

Critical Infrastructure Spatial Data Layers Available on GeoStor:

Source: United States Geological Survey

Pipelines 100K (DLG)
Power Stations 100K (DLG)
Aqueducts (DLG)
Buildings (GNIS)
Crossings (GNIS)
Hospitals (GNIS)
Oilfields (GNIS)
Reservoirs (GNIS)
Sewage Disposal Ponds (DLG)
Weigh Stations (DLG)
Power Lines 100K (DLG)
Airports (GNIS)
Bridges (GNIS)
Churches (GNIS)
Dams (GNIS / DLG)
Levees (GNIS)
Post Offices (GNIS)
Reservoirs (DLG)
Towers (GNIS)

Source: Energy Information Administration

Electric Providers 2001

Source: Arkansas Highway and Transportation Department- 2000

Power Plants
Power Substations
Pumping Stations Oil and Gas
Radio and Television Stations
Airports
Armories
Boat Docks or Piers
Boat Ramps
Dams and Locks
Drainage Ditches
Factories or Plants
Fire Engine Houses
Forest Ranger Stations
Gas Tanks
Gauging or Pumping Stations
Leeves or Dikes
Oil Tanks
Post Offices
Railroads
Water Supply Tanks or Standpipes
Schools

Source: Bureau of Transportation Statistics

Airport Runways
Airports
Amtrak Stations
Intermodal Shipping Terminals
Navigable Waterways
Railroads

Source: Unknown at this time.
Standards: Unknown at this time.
Priority: Unknown at this time.
Estimated total investment in this theme: Unknown at this time.
Estimated current state and local contributions: Unknown at this time.

What is needed? Unknown at this time.
What is a likely source? Unknown at this time.
Estimated total investment to complete this theme? 5,400,000
Estimated current allocations of funding? Unknown at this time.
Possible ways to overcome this gap? Unknown at this time.

Most appropriate data steward: Unknown at this time.
Maintenance: Unknown at this time.
Estimated maintenance cost: Unknown at this time.

12.4 Theme: DIGITAL ORTHOPHOTOGRAPHY

Digital orthophotography are scanned aerial photographs in which distortions from scale, tilt and topography have been reduced and/or removed. Digital orthophotography can also be thought of as a "photomap", having the orthographic projections of a map, with the qualities and characteristics of a photograph. Instead of lines, symbols and contours, these images have georeferenced pixels, which contain continuous data values pertaining to spectral reflectance values recorded by the sensor.

Status: Currently statewide first generation digital ortho quarter quads (DOQQ's) are based on the National Aerial Photography Program (NAPP) and National Digital Ortho Program (NDOP) specifications, with a vintage of 1994-96. The production of the second generation DOQQ's resulted in color-infrared photography and was created NAPP and NDOP specifications. Flights for the second generation DOQQ's began in 2000 and continued through 2001 and 2002.

Little Rock NW

Little Rock NW

DOQQ's Available on GeoStor:

Source: United State Geological Survey

First Generation DOQQ's

Source: Arkansas State Land information Board

Second Generation DOQQ's

Source: The source for the first generation DOQQ's, is the United States Geologic Survey. The source for the second generation DOQQ's, is the Arkansas State Land Information Board.

Standards: First and second generations follow the standards established by the USGS "National Mapping Program Technical Instructions Standards for Digital Orthophotos" 1996. Photography is flown to NAPP specifications and the DOQQ's are created to NDOP specifications.

Priority: Complete the acquisition and processing of the second generation DOQQ's.

Secure funding to acquire 1-foot resolution DOQQ's for urbanized areas.

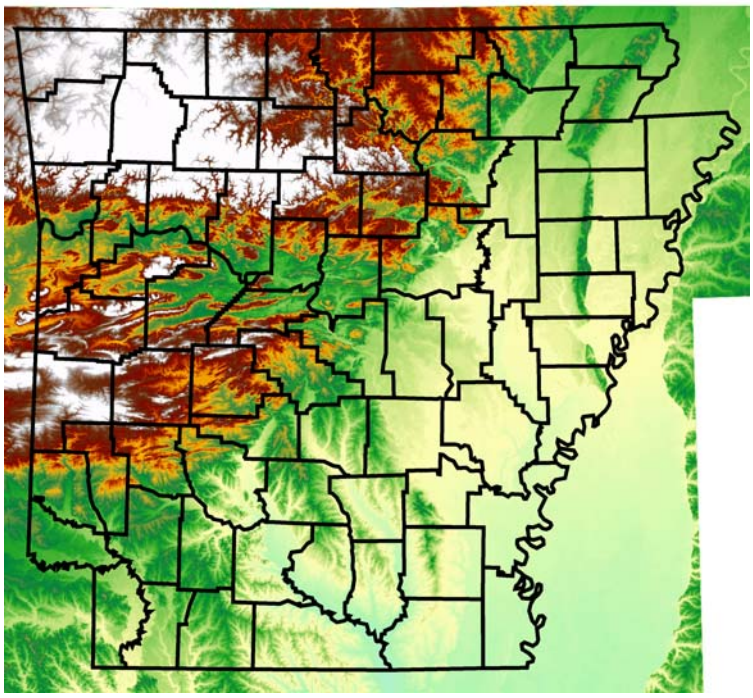
Estimated total investment in this theme: Second generation DOQQ's $1,421,441

Estimated current state and local contributions:

State Contributions	$382,938
Local Contributions	$62,688
Private Contributions	$122,290
Federal Contributions	$203,194

What is needed? Sustained local, state, federal and private partnerships.
What is a likely source? Unknown at this time.
Estimated total investment to complete this theme? $1,421,441
Estimated current allocations of funding? Unknown at this time.
Possible ways to overcome this gap? Unknown at this time.
Most appropriate data steward: Unknown at this time.
Maintenance: Unknown at this time.
Estimated maintenance cost: Overhead and Administration to date is approximately $160,000.

12.5 Theme: ELEVATION



The FGDC "Framework Introduction and Guide" explains "elevation as data to provide information about terrain. Elevation refers to a spatially referenced vertical position above or below a datum surface. The framework includes the elevations of land surfaces and the depths below water surfaces (bathymetry)." Elevation data can be used as a representation of the terrain, such as a contour map, post elevations or a three-dimensional perspective. The data can also be used to build models to perform applications ranging from line-of-sight calculations, to transportation planning, and watershed management. Elevation data is often combined with other digital data themes for modeling and mapping applications.

There are many ways to represent elevation data sets and/or models. The standard product that the U.S. Geological Survey (USGS) produces and uses is represented as a digital elevation model (DEM) collected in 10- or 30-meter grid spacing with coverage in 7.5- x 7.5-minute blocks. Each coverage provides the same coverage as a standard USGS 7.5-minute quadrangle without over edge. Additionally seamless and multi-resolution digital elevation data sets are now becoming available through the USGS.

Federal, State and local government agencies have created additional project specific elevation data sets.

Status:
State coverage for 30-meter DEMs is 100%. Approximately 10% of the state coverage for the 10-meter DEMs are available. Some counties, cities, state and federal agencies have acquired even more detailed elevation data such as two (2) foot contours.

Elevation Spatial Data Layers Available on GeoStor:

Source: United States Geological Survey

Areas to be submerged DLG 100k	Hypsography (contours), DLG 100K
Aspect (0-360) NED	National Digital Elevation Dataset
Hill Shade (Shaded Relief)	Ridges (GNIS)
Slope (Degrees) NED	Slope (Percent) NED
Summit (GNIS)	Valleys (GNIS)

Source: Primary sources for DEMs are the USGS. Primary source for the DLGs is the USGS.

Standards: Standards for DEMs are described in the USGS 'National Mapping Program Technical Instructions Standards for Digital Elevation Models,' dated January 1998.

Priority:
Estimated total investment in this theme: Various agencies have sponsored the creation of 10 meter DEMs for approximately 140 7.5-minute quads in the state. The cost to the agencies was approximately $96,000. The cost of production of the 10 meter DEMS is shared 50/50 by the requesting agency and the USGS. It is estimated that 1.5-2 million dollars is spent annually by other federal, state and local agencies to acquire more detailed elevation data.

Estimated current state and local contributions: Contributions have been from both the state and federal sectors.

What is needed? Unknown at this time.
What is a likely source? Unknown at this time.

Estimated total investment to complete this theme? $42,400,000 DEM with 5 meter posting

Estimated current allocations of funding? Unknown at this time.
Possible ways to overcome this gap? Unknown at this time.

Most appropriate data steward: The primary archive and distribution point for elevation data produced by the USGS is located at the EROS Data Center (EDC) in Sioux Falls, South Dakota. The general public can order elevation data from this database.

Maintenance: Unknown at this time.
Estimated maintenance cost: Unknown at this time.

12.6 Theme: GEODETIC CONTROL

The geodetic control theme provides important information to persons needing access to highly accurate control stations in Arkansas. Each control stations carries information about its position (3D), recovery, and establishment. The Federal Base Network (FBN) will become the control network to which all other framework data layers will derive their accuracy standards.

Status: In 1994 the National Geodetic Survey (NGS) began the Arkansas High Accuracy Reference Network (HARN) project, implementing a strategic plan, which defined a100-km, spaced network of HARN stations as the FBN and the remainder of the HARN stations or stations later established to B-order specifications constrained to the FBN as the Cooperative Base Network (CBN). Additional information concerning Arkansas' HARN efforts can be found at http://www.cast.uark.edu/cast/projects/gps/harn.html and at http://www.ngs.noaa.gov/PROJECTS/FBN/ . The NGS has completed adjustment of the Federal and Cooperative Base Networks (FBN/CBN) for Arkansas. Consisting of 101 stations, 32 new and 69 existing National Spatial Reference System (NSRS) control stations is spaced at approximately 50-kilometer (31-mile) intervals.

Source: The NGS and Arkansas State Land Surveyors Office are responsible for standards and future development of the geodetic control network in Arkansas. Other agencies, such as the AHTD provide important contributions to this network. The Arkansas State Land Commissioner, Division of Land Survey maintains original survey markers and survey record documentation and establishes uniform professional surveying and mapping methods and standards within the state.

Standards: The FBN/CBN network was observed to A and B-Order accuracy standards (5 mm + 1:10,000,000 and 8 mm + 1:1,000,000) as defined by the Federal Geodetic Control Subcommittee.

Priority: Improving densification of existing control stations is an important issues and will become more critical as the use of Global Positioning System (GPS) becomes commonplace. The development of a statewide cadastral layer will rely on the availability of local control network stations.

The Geodetic Control I-Team recognizes the need for greater emphasis on availability, coordination, and application of NGS approved control (NAD 83) when undertaking GIS enterprise projects. Therefore the following recommendations are set forth:

1. The Arkansas State Land Information Board supports the idea of the State Surveyor Office taking a leadership role in coordinating and advising on geodetic related issues that arise on geographic information projects.

2. The Arkansas State Land Information Board supports the idea of the integration of all verifiable stations (HARN, USGS Bench Marks, FEMA RM's, AHTD's project control points and benchmarks – spatial data layers). Any changes to these data sets must be authorized through the State Surveyor's Office.

The State Land Information Board feels GeoStor could serve as the 'official' geodetic web reference site and be updated / maintained by the State Surveyors Office. This site could then be linked to from other related state web sites such as the AHTD, State land Surveyors Office and other pertinent Web Sites.

3. The Arkansas State Land Information Board supports the idea of the establishment of a Geodetic State Advisor position - located in the State Surveyor's Office. Arkansas' share will be $47,000/year. This position will liaison with the State Land Information Board and Geographic Information Office on geographic information issues that contain a geodetic component.

4. The Arkansas State Land Information Board supports the idea of the establishment and adoption of standards/certification for use of global positioning systems (GPS) within the surveying community. The State Land Information Board believes this will assist the geodetic control work in Arkansas.

It should be understood that the Surveying GPS standards and the Mapping Grade GPS Standards are intended for different uses. Therefore the appropriate standard should be used when collecting data with a GPS.

5. The Arkansas State Land Information Board supports the idea of an increased densification of CORS (Continuously Operating Reference Stations) and improved accessibility of all NGS level control stations. It is understood that an individual CORS cost approximately $25,000.

The Arkansas State Land Information Board understands that the Arkansas Highway & Transportation Department (AHTD) is the lead agency on this issue and will assist Arkansas Highway & Transportation Department with densification plans of temporary and permanent CORS.

6. The Arkansas State Land Information Board supports the idea of establishing geographic information on existing stations and section corners. The Geodetic Control I-Team subcommittee fully supports efforts by the PLSS Team to undertake this task. Annual cost for monumentation and corner recovery is estimated at $200,000 annually.

Estimated total investment in this theme: Unknown at this time.
Estimated current state and local contributions: Unknown at this time.

What is needed? Densification of existing control network will be an ongoing process driven by local needs for access to geodetic information for local/regional enterprise projects.

What is a likely source? Unknown at this time.
Estimated total investment to complete this theme? 5,000,000
Estimated current allocations of funding? Unknown at this time.
Possible ways to overcome this gap? Unknown at this time.

Most appropriate data steward: By state law the Office of the State Land Surveyor is responsible for maintaining original survey markers and survey record documentation.

Maintenance: Unknown at this time.
Estimated maintenance cost: Unknown at this time.

12.7 Theme: GEOLOGY

Geologic mapping has been ongoing for years, and the change to a digital format has been going on since 1995.

12.7.1 *Theme:* Surface Geology

The surface geology is important in finding natural resources, delineating geohazards, and serve as a basis for land use, such as landfills, city planning, and regional economic development.

Status: There are nine hundred seventeen (917) 7.5" topographic maps, scale 1:24,000, in the state of Arkansas. Thirty-seven (37) of these maps have the geology theme digitized and eight hundred eighty (880) need to be digitized. About twenty-five (25) quadrangles per year can be digitized from completed geologic maps. Digitizing costs are estimated to be $3,000 per 7.5" quadrangle. At this rate it would take thirty-five (35) years and over $250,000 to digitize the geology theme for the entire state. All maps will meet geologic mapping standards set by the United States Geological Survey, Association of American State Geologists, and the Arkansas Geological Commission. Our goal is to shorten the amount of time required to digitize the geology theme and find additional funding for the geologic mapping.

Source: Arkansas Geological Commission

Standards: Mapping standards are a compilation of standards set forth by the U.S. Geological Survey and the Arkansas Geological Commission, (National Geologic Mapping Act).

Priority: Geology with sub-themes: surface geology, hydrology, industrial mineral, fossil fuel, & geohazards. Organize mapping projects within the state to insure compatibility and meet mapping standards.

Estimated total investment in this theme: Unknown at this time.

Estimated current state and local contributions: The STATEMAP program, a part of the National Geologic Mapping Act is a cooperative effort between the U.S. Geological Survey and Arkansas Geological Commission to standardize geologic maps in the state and make them available in the digital format. Currently, funding from STATEMAP (USGS) and the AGC is over $100,000 annually. The AGC has two employees working full time upgrading geologic maps that will be digitized and existing geologic maps that meet standards are being digitized at a rate of twenty-five (25) per year. The Arkansas Geological Commission is committed to complete statewide coverage of geologic maps in the digital format. Geologic mapping in the state of Arkansas is the responsibility of the Arkansas Geological Commission and the AGC has the authority to apply for grants and engage in cooperative programs with the U.S. Geological Survey to supplement the mapping effort. Maintenance costs of geologic maps is part of the AGC program and the

digital geology theme would be minimal, only minor changes will occur on a yearly basis as additional geologic research reveals new geologic information.

What is needed? Increase funding to speed up the process. Quadrangles that require additional geologic mapping cost between $18,000 and $30,000 to complete.

What is a likely source? USGS grants, state funding, and local involvement.

Estimated total investment to complete this theme? Unknown at this time.

Estimated current allocations of funding? Arkansas Geological Commission budget will contain geologic mapping funds and is expected to receive annual STATEMAP grant funds from the USGS.

Possible ways to overcome this gap? Develop other sources of funding.

Most appropriate data steward: Arkansas Geological Commission (designated by law).

Maintenance: Unknown at this time.
Estimated maintenance cost: Unknown at this time.

12.7.2 Theme: **Industrial Minerals**
Location of known and possible mining sites will enable regional and city planners to devise ways to keep this resource as close as possible to populated areas to keep cost down, and design infrastructure.

Status: Industrial mineral locations maintained by the Arkansas Geological Commission.

Source: Arkansas Geological Commission

Standards: Mapping standards are a compilation of standards set forth by the U.S. Geological Survey and the Arkansas Geological Commission.

Priority: Maintain an accurate database of mineral resources.

Estimated total investments in this theme: Unknown at this time.

Estimated current state and local contributions: Unknown at this time.

What is needed? Unknown at this time.

What is the likely source? Arkansas Geological Commission.

Estimate total investment needed to complete this theme: Unknown at this time.

Estimate the current allocation of funding; include current state and local contributions (budgeted, needed, gap): Database maintained by Arkansas Geological Commission.

Describe possible ways to overcome this gap: Unknown at this time.

Most appropriate data steward: Arkansas Geological Commission

Maintenance: Adding current data.

Estimated maintenance costs: Unknown at this time.

12.7.3 Theme: **Fossil fuels**

Fossil fuels include: oil, gas, coal, and lignite resources. Having this type of database would greatly facilitate in the exploration and recovery of these resources. The Arkansas Geological Commission is compiling databases on fossil fuels in ArcView: they include north Arkansas gas fields, south Arkansas oil and gas fields, Arkansas Valley coal map showing surface mines, subsurface mines and reclaimed lands, coal-bed methane wells, and bromine wells in Union County. These maps are works in progress. The Arkansas Oil and Gas Commission has a database of all oil and gas wells in the state, but the database will require additional work to meet digital standards. Total investment is not known at this time but requires one full time employee to compile and update these files. The State of Arkansas provides funding.

Status: Most data in paper files.

Source: Arkansas Geological Commission, Arkansas Oil and Gas Commission.

Standards: Unknown at this time.

Priority: Transfer data to an electronic database.

Estimated total investments in this theme: Unknown at this time.

Estimated current state and local contributions: N/A

What is needed? Funds.

What is the likely source? Unknown at this time.

Estimate total investment needed to complete this theme: Unknown at this time.

Estimate the current allocation of funding, include current state and local contributions (budgeted, needed, gap): Unknown at this time.

Describe possible ways to overcome this gap: Coordinate activities with the Arkansas Oil and Gas Commission.

Most appropriate data steward: Arkansas Geological Commission, AR Oil and Gas Commission

Maintenance: Unknown at this time.
Estimated maintenance costs: Unknown at this time.

12.7.4 Theme: **Geohazards (earthquakes, sink holes, landslides)**
Knowing areas that are at relative high risk will enable emergency response to be more effective. Also, avoiding these areas can save lives and money, and protect natural resources. Presently, a liquefaction potential map in eastern Arkansas, a regional seismic intensity maps of the New Madrid seismic zone, and slump features identified on county highway maps are complete. This leaves landslide potential areas, and areas not along the county highways where slump potential is relatively high and karst features with no active work being performed. Flood prone area mapping is maintained by FEMA. While geologic mapping is being conducted under STATEMAP any geologic hazard features will be identified and added as a digital layer to the map.

Status: 1 x 2 degree Memphis liquifaction risks map prepared for CUSEC, no sink hole map, limited landslide information.

Source: Arkansas Geological Commission.

Standards: Mapping standards are a compilation of standards set forth by the CUSEC State Geologist, U.S. Geological Survey and the Arkansas Geological Commission.

Priority: Defining areas of high relative risk.

Estimated total investments in this theme: Unknown at this time.

Estimated current state and local contributions: N/A

What is needed? Equipment, personnel, and federal grants.

What is the likely source? Unknown at this time.

Estimate total investment needed to complete this theme: Not known at this time.

Estimate the current allocation of funding, include current state and local contributions (budgeted, needed, gap): minimal.

Describe possible ways to overcome this gap: Unknown at this time.

Most appropriate data steward: Arkansas Geological Commission, Arkansas Department of Emergency Management.

Maintenance: Unknown at this time.
Estimated maintenance costs: Unknown at this time.

12.7.5 Theme: Hydrology

This theme is important for the protection and usage of the surface waters and groundwater resources in the state. Hydrology theme data are currently maintained by the U.S. Geological Survey-Water Resources Division and supported through cooperative programs by the Arkansas Geological Commission and other state and federal agencies. The Water Well Construction Division of the Arkansas Soil and Water Conservation Commission maintains water well records of over 211,000 water wells. They are compiling a database of these wells starting with the present and working backwards in time. A database of the water well construction reports would initially include field coverage for latitude/longitude location in decimal degrees, legal land description, land surface elevation, date of construction, ground water site use, producing horizon, total depth, initial yield, water chemistry, and a notes field.

Status: Unknown at this time.

Source: Arkansas Geological Commission and U.S. Geological Survey Water Resource Division

Standards: Mapping standards are a compilation of standards set forth by the U.S. Geological Survey and the Arkansas Geological Commission.

Priority: GPS locations, lithology, total depth, water yield, water quality, and etc. for new water wells.

Estimated total investments in this theme: Unknown at this time.

Estimated current state and local contributions: Various state and federal cooperative programs for the collection of data.

What is needed? Unknown at this time.

What is the likely source? State and Federal funding.

Estimate total investment needed to complete this theme: Unknown at this time.

Estimate the current allocation of funding, include current state and local contributions (budgeted, needed, gap): Numerous state agencies contribute to water data collection programs.

Describe possible ways to overcome this gap: Unknown at this time.

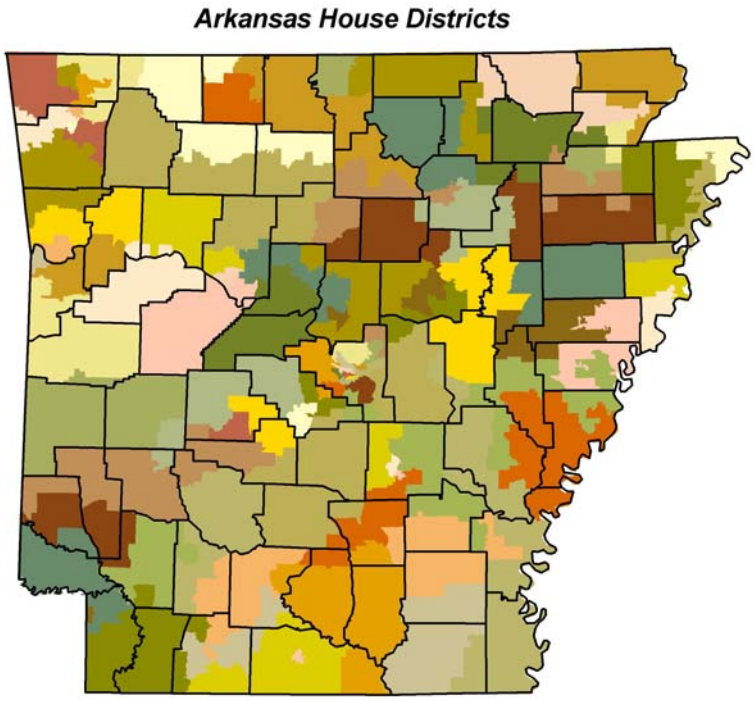
Most appropriate data steward: Arkansas Geological Commission, U.S. Geological Survey Water Resource Division, ADEQ, ASWCC, and the AHD.

Maintenance: Unknown at this time.

Estimated maintenance costs: Unknown at this time.

12.8 Theme: GOVERNMENTAL UNITS

Governmental units are geographically defined areas for such purposes as jurisdiction, taxation, administration, representation and elections. Governmental units include the state, counties, townships, cities, school districts, judicial circuits, electoral zones and districts, precincts, levy districts, fire protection districts, water districts, etc.



Status: The United States Census Bureau and the AHTD maintain much of the geographic data related to governmental units. The census files will be as accurate as the data the United States Census Bureau receives from local authorities (1999). Cities, counties and school districts maintain their own data, and it should be noted that their data is often inconsistent with that maintained by other entities. It is Unknown at this time. the extent to which these entities maintain spatial and attribute data digitally. County clerks and election commissions maintain data related to precinct boundaries and other election zones within their jurisdiction. This data is reported to the United States Census Bureau, but we know that there are conflicts between the lines actually used by the counties and the United States Census Bureau's version of these lines. Precinct maps are also reported to and maintained by the Arkansas Secretary of State's Office and the Arkansas Attorney General. Administrative personnel for fire protection and water districts also maintain boundary files. At this time it is not known whether these boundary files are maintained in digital format. The Arkansas Secretary of State maintains congressional and state legislative districting data in digital form. Counties create and maintain county legislative (quorum court) districts and report them to the Arkansas Secretary of State. Cities create and maintain wards and aldermanic electoral zones; school districts create and maintain electoral zones for school boards. The Arkansas Administrative Office of the courts maintains data regarding judicial circuits and electoral districts for the Arkansas Court of Appeals.

Governmental Spatial Data Layers Available on GeoStor:

Source: United States Bureau of the Census- TIGER

106th Congressional Districts
Civil Divisions 2000 (1999)
Counties 1990 (2000)
Civil Divisions 1990 (1999)
Civil Divisions 2000
Counties 2000 (1999)

Counties 2000
County Boundaries 1990
Metropolitan Areas 1999
Places 2000 (1999)
School Districts 1999
Urban Areas 1999
Voting Districts 2000 (1999)
County Boundaries 1990 (1998)
County Boundaries 1998
Places 1990 (1999)
Places 2000
Unified School Districts 1998
Voting Districts 1998
Voting Districts 2000

Source: Arkansas Secretary of State

Arkansas State House of Representatives 1990
Arkansas State House of Representatives 2001
Arkansas State Senate 1990
Arkansas State Senate 2001

Source: Arkansas Highway & Transportation Department

City Limits 2000
National Forest Boundaries 2000

Source: United State Geological Survey Digital Line Graph

Federal Reservations 100K
State Forest or Grasslands 100K
State Reservations 100K
National Wildlife Refuges 100K
State Parks 100K
State Wildlife Refuges

Source: Arkansas Secretary of State's Office, Arkansas Highway and Transportation Department, United States Census Bureau (TIGER), the Arkansas Administrative Office, and Arkansas cities, counties and school districts.

Standards: Vary, among each of spatial data layers described above.

Priority: The first priority is to identify all governmental units, then to assure compatibility of spatial data and spatial data integration. The overall governmental unit theme is a high priority.

Estimated total investment in this theme: Unknown at this time.
Estimated current state and local contributions: Unknown at this time.

What is needed? The state should require governmental units to report their spatial data to a state agency so that this data can be maintained in a comprehensive and compatible format. It is unclear at this time the amount of funding that will be needed for this project.

What is a likely source? Unknown at this time.
Estimated total investment to complete this theme? $3,600,000
Estimated current allocations of funding? Unknown at this time.
Possible ways to overcome this gap? Unknown at this time.
Most appropriate data steward: Unknown at this time.
Maintenance: Unknown at this time.
Estimated maintenance cost: Unknown at this time.

12.9 Theme: HYDROGRAPHY

Hydrographic data layers for Arkansas include surface water features such as lakes, ponds, rivers, streams, ditches, canals, and shorelines. Additionally, hydrographic layers include hydrologic units.

Status:
Hydrographic Data Layers Available on GeoStor:

Source: United State Geological Survey

Canals (GNIS)
Canals and Ditches (100k DLG)
Channels (GNIS)
Ditches (Polygons, 100K DLG)
Lakes (GNIS)
Lakes or Ponds (100K DLG)
Reservoirs (GNIS)
Reservoirs (100K DLG)
Streams (GNIS)
Streams (Polygons, 100K DLG)
Streams (100k DLG)
Swamps (GNIS)
Wetlands, Swamps, or Marshes (100K DLG)
National Hydrography Dataset- Basins, Drainages, Landmarks (lines, points, polygons), Nodes, reaches, Waterbodies

Source: Arkansas Highway & Transportation Department

Drainage Ditches (AHTD)

Source: United States Bureau of the Census- TIGER

Hydrography Lines (1998)
Hydrography Lines (1999)
Hydrography, Lines (2000)
Hydrography Polygons (1998)
Hydrography Polygons (1999)
Hydrography, Polygons (2000)

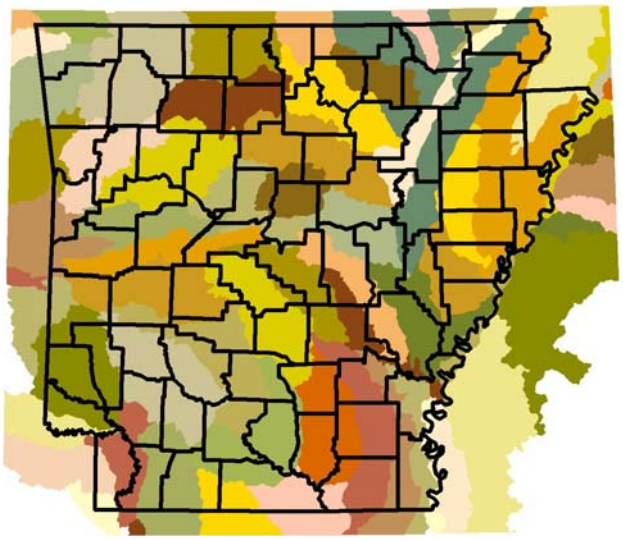
Source: Natural Resource Conservation Service

Hydrologic Basins (Watersheds) (8 Digit, 1994)

Source: Bureau of Transportation Statistics

Navigable Waterways (1999)

8-Digit Hydrologic Unit Boundaries



Additional statewide spatial data layers available on various websites include, but are not limited to the following:

- Digital Chart of the World (DCW) Drainage Networks (1:1,000,000)
- The United States Environmental Protection Agency's (USEPA) Reach Files
- A series of national hydrologic databases that identify and interconnect the stream segments ("reaches") that comprise surface water drainage systems in the United States three versions of the Reach Files currently exist (RF1, RF2, and RF3-Alpha).
- USGS Enhanced River Reach (ERF1) files include enhancements to the USEPA River Reach File 1 (RF1).

As an ongoing federal initiative the USGS and member agencies of the FGDC, Subcommittee on Spatial Water Data have lead the effort to promote the development of nationally consistent hydrologic unit coverage. The USGS, United States Forest Service, Bureau of Land Management, and National Oceanic and Atmospheric Administration (NOAA) are assisting Natural Resource Conservation Service (NRCS) in the review and verification of hydrologic units.

The hydrologic unit state coordinator is Pam Cooper of the NRCS. Progress of the NRCS watershed and sub-watershed delineation in Arkansas is outlined below.

12.9.1 Theme: Hydrologic Unit (5th and 6th level)
Status: Arkansas is 25–75% complete
(http://www.ftw.nrcs.usda.gov/HUC/hucstatusstate.jpg)
(http://data4.ftw.nrcs.usda.gov/website/huc_contus/viewer.htm)

Source: Natural Resource Conservation Service.

Standards: National Map Accuracy Standards for 1:24,000 scale maps
(http://www.ftw.nrcs.usda.gov/HUC/HU_standards_120601.doc)

(http://www.ftw.nrcs.usda.gov/HUC/ni170304.html)

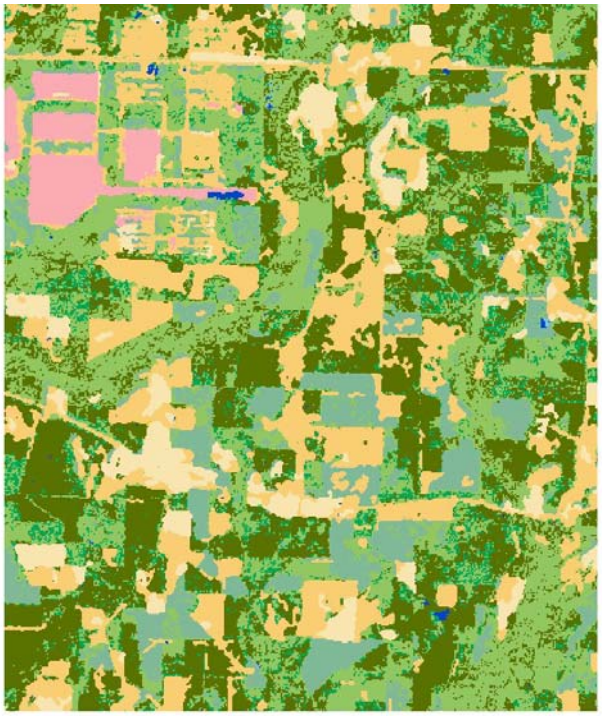
Source: Unknown at this time.
Standards: Unknown at this time.
Priority: Unknown at this time.
Estimated total investment in this theme: Unknown at this time.
Estimated current state and local contributions: Unknown at this time.
What is needed? Unknown at this time.
What is a likely source? Unknown at this time.
Estimated total investment to complete this theme? Unknown at this time.
Estimated current allocations of funding? Unknown at this time.
Possible ways to overcome this gap? Unknown at this time.
Most appropriate data steward: United States Department of Agriculture, Natural Resource Conservation Service.
Maintenance: Unknown at this time.
Estimated maintenance cost: Unknown at this time.

12.10 Theme: Land Use / Land Cover

Land use and land cover data "LU/LC" is useful for environmental assessment of land use patterns with respect to water quality analysis, growth management, and other types of environmental impact assessments.

Land cover is a more resource-oriented classification used for environmental assessments and can be obtained from data at varying scales and data sources (AVHRR, Landsat MSS & TM, SPOT, etc.). This information can help monitor environmental changes over time over wide areas and can, to a degree, be incorporated into more detailed Land Use studies.

Land Use Land Cover (Spring 1999)- LandSat 7



Land use is a more detailed classification based more on various activities and people and relies on data with greater detail (i.e. IKONOS, SPOT PAN 10m, aerial photographs, etc). Data of this nature can help monitor phenomena such as "urban sprawl", loss of green-space and industrial growth.

Status: Statewide data sets are complete for the period prior to 1999. Updated land use/land cover data is required on a periodic basis. Projected requirements are ten-year cycles for general land cover and forestry, five-year cycles for agriculture and more frequent but variable for local land use as local

requirements will define land use needs. Rapidly growing areas of the state, e.g. Central Arkansas, Northwest Arkansas will require more frequent updates.

Source: Nine sources are known for this data layer. (1) The Geographic Information Retrieval and Analysis System (GIRAS) Landuse/Landcover data for the Conterminous United States by quadrangles at a scale of 1:250,000, (2) The 1999 Landuse/Landcover data sets (Spring, Summer, and Fall) of Arkansas from University of Arkansas' Center for Advanced Spatial Technologies (CAST), (3) 1990-1995 GAP 100 Ha MMU (minimum mapping unit) Landcover, (4) 1992-1995 30 m cell GAP Landcover (5) 2 Ha (minimum mapping unit) GAP Landcover (6) 10 Ha (minimum mapping unit) GAP Landcover (7) 40 Ha (minimum mapping unit) GAP Landcover and (8) 1990s 30 M cell-resolution , 21 category, National Land Cover Dataset (NLCD) – Preliminary Version -from the Multi-Resolution Land Characterization Consortium (USGS, EPA, NOAA, and USFS) and (9) 2000 30 M cell-resolution National Land Cover Dataset (NLDC) – from the Muli-Resolution Land Characterization Consortium (USGS, EPA, NOAA, and USFS).

Detailed description
(1) The GIRAS Landuse/Landcover digital data was collected by the USGS and converted to ARC/INFO by the EPA. The data dates from 1977-1980.

(2) The 1999 Landuse/Landcover data set from CAST is available for download from GeoStor. The approximate size of the file is 213 MB. The map depicts the land-use and land-cover of Arkansas as it occurred in the spring, summer, and fall seasons of 1999. The data was derived from Landsat TM 5 scenes and extensive ground-truth information. The maps focus primarily on agricultural land-use: crops and pasture lands. Map categories fall with 6 broad "Level 1" categories: water, forest, barren, herbaceous, agricultural lands, and urban. Each level 1 category is broken into several more discrete "Level 2" subcategories. The Arkansas Soil and Water Conservation Commission supported the project. Project details are provided at http://www.cast.uark.edu/local/arlulc99/index.html

(3-7) The multiple resolution 1990-1995 GAP Land Cover data sets were derived from a digital classification of Landsat Thematic Mapper (TM) imagery, mostly from 1992 and are available for download from GeoStor. The data was prepared and compiled in compliance with the National GAP effort and supported by USGS and local cooperators. Final products are 100 Ha MMU shape files. In addition, however, base raster products that were generalized to the 100 Ha MMU products are also available. These are 30 M, 2 Ha MMU, 10 Ha MMU and 40 Ha MMU. A generalizing algorithm was applied to the initial 30 M classified products to derive each larger MMU. When the required national GAP required 100 MMU product was developed it was then vectorized.

(8) National Land Cover Data (Preliminary)
Derived from the early to mid-1990s Landsat Thematic Mapper satellite data, the National Land Cover Data (NLCD) is a 21-class land cover classification scheme applied consistently over the United States. The spatial resolution of the data is 30 meters and mapped in the Albers Conic Equal Area projection, NAD 83. The NLCD are provided on a state-by-state basis. The state data

sets were cut out from larger "regional" data sets that are mosaics of Landsat TM scenes. At this time, all of the NLCD state files are available for free download as 8-bit binary files and some states are also available on CD-ROM as a Geo-TIFF. The TM multi-band mosaics were processed using an unsupervised clustering algorithm. Both leave-off and leave-on data sets were analyzed. The resulting clusters were then labeled using aerial photography and ground observations. Clusters that represented more than one land cover category were also identified and, using various ancillary data sets, models developed to split the confused clusters into the correct land cover categories. The Arkansas data is available for download from http://edcwww.cr.usgs.gov/pub/data/landcover/states/arkansas_NLCD_0800_flat.bin.gz.

Publication date is August 8, 2000

(9) 2000 National Land Cover Data
The Multi-Resolution Land Characteristics (MRLC) Consortium was originally formed in 1992 in order to meet the needs of several federal agencies (USGS, EPA, NOAA, and USFS) for Landsat 5 imagery, and land-cover information. The on-going need for current Landsat 7 data, land-cover and other geospatial data within the federal government culminated in reforming the MRLC Consortium in 2000 (called MRLC 2000).

The MRLC 2000 strategy includes: acquisition of a multi-temporal Landsat 7 TM data centered around the year 2000 that includes three dates of imagery per path-row; preprocessing of these data using common methods and standards, and; generation of a consistent national land-cover database. The MRLC members recommend that the National land cover data assessment be coincident with the decadal national population census.

Data from Landsat 7 is being used for MRLC 2000. MRLC 2000 pre-processing specifications include: a minimum of three dates per path/row (representing different seasonality) for the conterminous lower 48 US states, Alaska, Hawaii and Puerto Rico; geometric terrain-corrected registration to within one pixel spatial accuracy; data referenced to the National Albers Equal map projection; imagery re-sampled using cubic convolution to 30m pixels, and; all 8 TM bands processed (including thermal and pan bands).

Standards:
(1) GIRAS. GIRAS standards are detailed at
http://www.epa.gov/ngispgm3/nsdi/projects/giras.htm

(2) The Arkansas LULC Project standards are provided at:
http://www.cast.uark.edu/local/arlulc99/index.html

(3-7) GAP data was created according to National GAP standards
Scott, J. M., et al. 1993. "Gap Analysis: A Geographic Approach to
Protection of Biological Diversity"
http://www.gap.uidaho.edu/About/Overview/WildlifeMonographs/default.htm".
Wildlife Monographs; The Wildlife Society as implemented by the Arkansas GAP Effort–
http://www.cast.uark.edu/gap/

Vegetation classification structure: Foti, Li, Blaney and Smith "A classification system for natural vegetation in Arkansas" http://www.cast.uark.edu/cast/projects/gap/landcover/foti.html

(8) 1990s National Land Cover Data standards are provided at:
http://landcover.usgs.gov/prodescription.html

(9) 2000 National Land Cover Data standards are provided at:
http://edcw2ks15.cr.usgs.gov/lccp/mrlc2k/mrlc2k_desc.asp

Priority: Landuse/Landcover was determined to be a framework data layer.
Estimated total investment in this theme: $910,000 (Gap - $630,000), (LULC – $280,000) plus an unknown Federal investment in MRLC?NLCD and GRIAS.
Estimated current state and local contributions: $380,000.

What is needed? Revisions of forest cover and habitat are projected to be required on a decadal basis. NLCD is proposed to correspond with decadal Census. Revisions of agricultural data sets on a five-year basis (corresponding with 5 year Agricultural Census) and other as required locally.

What is a likely source? For forest and agricultural: Landsat and future 30-10 M satellite sensors. More detailed land use based on higher resolution satellite sensor (IKONOS and QucikBird multi-spectral) and aerial photography.

Estimated total investment to complete this theme? $500,000

Estimated current allocations of funding? Unknown at this time.
Possible ways to overcome this gap? Unknown at this time.

Most appropriate data steward: Arkansas State Land Information Board

Maintenance: Unknown at this time.
Estimated maintenance cost: Unknown at this time.

12.11 Theme: PUBLIC LAND SURVEY SYSTEM (PLSS)

The Public Land Surveying System (PLSS) is designed for describing and conveying property. It is the foundation for land ownership and land ownership records in Arkansas. There are approximately 1541 six-mile square townships in Arkansas. It is based on monuments set at section and quarter section corners by government surveyors between the years 1815 and 1855. Most of these monuments were wooden posts, however stones were set in some areas and were called for in the original survey notes. In any case, most of these monuments that ultimately control the PLSS in Arkansas are no longer in existence. In some cases the location has been perpetuated by the actions of surveyors or landowners. Regardless of inaccuracies in the original measurements, the original location of the physical marker, based on the *best available evidence*, controls the location of that corner. Because the original surveys in Arkansas were performed with a magnetic compass, the precision is quite low by today's standards and sections that were intended to be one mile square are not square nor exactly 5280' to a side.

For mapping purposes and inclusion in an automated land management system or Geographic Information System, these corners need to have geodetic (latitude/longitude) coordinates. The PLSS layer in Arkansas will be the framework layer for anything dealing with land ownership.

Status: There are about 1541 townships in Arkansas. There is currently a PLSS layer available in Arkansas based on coordinates digitized from USGS maps. The Ozark National Forest has implemented a PLSS framework layer using the Bureau of Land Management (BLM) Geographic Coordinate Data Base (GCDB) Geographic Measurement Management (GMM) software. The software is available at no charge. This software allows the entry of the GLO notes from the original surveys and whatever ground coordinates are available. These coordinates may come from any reliable source. The software is designed to use a proper breakdown of the sections using BLM standards. It can handle variations to the standard, such as $1/16^{th}$ corners that are not exactly ½ way between adjacent ¼ corners. The files can be converted to a shapefile or other standard GIS file types.

The software can be continually updated, as more coordinates become available, so the layer will continually improve over time. As a minimum, five sets of corner coordinates will be entered into the software per township. One near each township corner and one near the center of the township. This method resulted in a 95% confidence that the corner locations were within 34' in a pilot project performed in one county in Nebraska. This is significantly better than the 300' or so error that can be found using coordinates digitized from USGS maps. Areas that have a high demand for accurate PLSS locations can improve the precision in their area by having additional corners added to the system through GPS observations. This software is consistent with the Federal Spatial Data Infrastructure.

PLSS Spatial Data Layers available on GeoStor:

Source: United States Geological Survey- Digital Line Graphs

Section Boundaries- Public Land Survey 100K

Township Boundaries- Public Land Survey 100K

Source: Arkansas Highway and Transportation Department
Section Boundaries- Public Land Survey 24K
Township Boundaries- Public Land Survey 24K

Source: The Ozark National Forest is complete. That includes about 120 townships. The GLO notes have been entered into the GCDB GMM software for the Ouachita National Forest. (This is unconfirmed at this time, but should be certain within a few days). There are approximately ?? townships in the Ouachita National Forest. This leaves 1420 townships that need to have GPS coordinates on what will amount to two to five corners per township because many share corners with adjacent townships. There are numerous instances where adjacent townships will not be able to share corners such as along standard lines, navigable rivers, the Cherokee Boundary Line, and other irregularities. We will use three per township for computational purposes.

Standards: The work of gathering the coordinate information will need to be completed by land surveyors using survey-grade equipment and procedures. The state of Arkansas is in the process of looking into hiring a geodetic advisor through NGS. This will benefit both the geodetic layer as well as the PLSS layer. In order to prevent having to re-observe in the near future, the committee recommends collecting the data to survey grade standards. The geodetic advisor would be in charge of training and certifying contracting surveyors who wish to perform the GPS observations and may be able to do the GPS data processing.

Priority: This is a framework layer. Land ownership is legally tied to the PLSS corners. As such, it needs to be completed before extensive projects using PLSS begin. Since the nodes can be upgraded, the user will need to update their data occasionally, but any data tied to the nodes should shift with the node when better coordinates become available for it.

Estimated total investment in this theme: Based on 1420 townships that remain to be completed.

Research of survey records at the State Surveyors Office:
$500 per township X 1420 Townships $710,000

Data entry of the GLO notes into the GCDB software:
Estimated at $500 per township if ONLY the GLO notes are entered
(Glen Thurow of InfoTec) $710,000
(Tthis will be a little less if Ouachitas are done)
Estimated at $1000 per township if InfoTec does the record research
Estimated cost is about the same as if the research
Is done at the State Surveyors Office

Training of personnel to maintain and improve the database
Estimated at $7000 per week if the training is done in Arkansas
With up to 10 trainees. $7000

GPS data collection on an average of three corners per township:
Two-person GPS crew and equipment
12 hours per township at $100/hour

(This is a contract amount and includes their overhead costs)
$1,704,000

Total: $3,131,000

Training and supervisory control of the GPS contractors:
NGS Geodetic Advisor – annual expense
State Cost (State Surveyors Office) $49,500
Federal Cost (NGS) $49,500

Estimated current state and local contributions: The Ozark National Forest is done using this method. That is a total of 120 townships. ($1000 for just the data entry and $800 for the GPS work per township would be $216,000)

The Ouachita National Forest has the GLO data entered into the GCDB software.
($1000 X number of townships) The forest is a potential partner in the funding.

The State Surveyors Office and the NGS may be able to fund the Geodetic Advisor. ($99,000)

What is needed? Unknown at this time.
What is a likely source? Unknown at this time.

Estimated total investment to complete this theme? $5, 408,865

Estimated current allocations of funding? Unknown at this time.

Possible ways to overcome this gap? The Ozark National Forest is done using this method. That is a total of 120 townships. ($1000 for just the data entry and $1200 for the GPS work per township would be $264,000)

The Ouachita National Forest has the GLO data entered into the GCDB software.
($1000 X number of townships) The forest is a potential partner in the funding.

The State Surveyors Office and the NGS may be able to fund the Geodetic Advisor. ($99,000 per year)

The BLM may be able to fund part of this effort to build the National Spatial Data Infrastructure.

AHTD has land survey information on several thousand sections in the state. Most of those that have been surveyed within the past five years have geodetic coordinates (SPCS) that they would make available for this project.

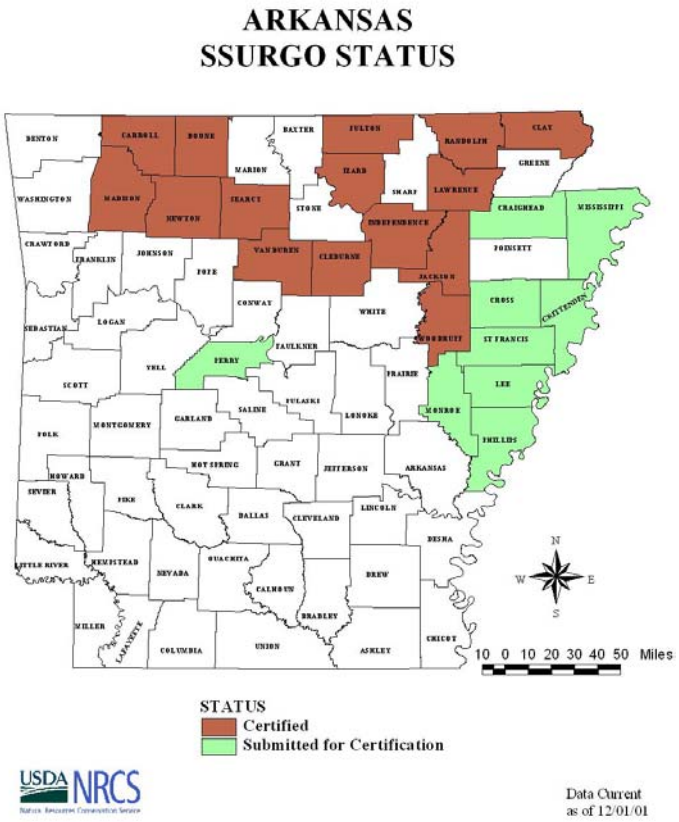
Most appropriate data steward: The State Surveyors Office should be the headquarters. The only person to make changes to the coordinate data or metadata will be the designated officials who will be a PLS.

Maintenance: There will need to be one person dedicated primarily to upgrading the information to the PLSS layer into the future if it is to have the utility that it has the potential to have. There will need to be significant warnings to the public about the nature of the data. This method should produce coordinates within about 30' of the ground coordinates in most instances. All users must understand that the node coordinate values in no way are mandatory corner locations for surveyors and that only a PLS through the medium of a sealed plat can determine the location of a property boundary corner.

Estimated maintenance cost: Unknown at this time.

12.12 Theme: SOILS

Status: Fifteen counties in Arkansas have digital soils layers SSURGO certified by the Natural Resources Conservation Service (NRCS); 9 counties are in the final stages of NRCS certification; 41 counties have been digitized and are waiting on quality reviews and certification; 17 counties have little or no work done toward developing the digital soils layer.



Soils Data Layers Available on GeoStor:
Source: Natural Resource Conservation Service
Soils SSURGO- Madison County
Soils SSURGO- Clay County
Soils STATSGO- Statewide

Source: Natural Resources Conservation Service

Standards: Meet National Map Accuracy Standards

Priority: Unknown at this time.

Estimated total investment in this theme:
Estimated current state and local contributions: Unknown at this time.

What is needed? Unknown at this time.
What is a likely source? Unknown at this time.
Estimated total investment to complete this theme? Estimated cost to complete the SSURGO certified soils database for Arkansas is $1,767,000.
Estimated current allocations of funding? Unknown at this time.
Possible ways to overcome this gap? Unknown at this time.

Most appropriate data steward: Natural Resources Conservation Service
Maintenance: Unknown at this time.
Estimated maintenance cost: Unknown at this time.

12.13 Theme: TRANSPORTATION

The transportation layers often include many features of transportation networks and facilities. For the purpose of the initial plan, only roads are included. For transportation issues related to growth, economic development, disaster preparedness, emergency response, and public land management, all roads must be included in the transportation network. Transportation data is currently developed and maintained separately, at different spatial accuracies by Federal, State and Local governments to support their existing business requirements for information, reporting, and management of the system. In order to make the most efficient use of available resources for the collection of information related to this theme, the common denominator for transportation data must be established. Priorities for transportation must be set and procedures for the accurate collection of data established at all levels of government. Obviously, such a database includes roads, bridges, rail, airports, and waterways.

Transportation data for use within geographic information systems (GIS), particularly *road centerline data*, is mission critical for the National Spatial Data Infrastructure (NSDI) framework data compilation effort. In most cases, data is developed and maintained in-house, including such entities as roads, highways, and other rights-of-way and physical features. In other cases, spatial data (geocoded) is created through reference to other sources, public and private. Preliminary work has just begun on the refined Arkansas Centerline File project to update and maintain centerlines in Arkansas. It is intended that the resulting spatial data layer will be more uniform and horizontally accurate with geocodeable attributes. This will facilitate the sharing of statewide seamless centerline spatial data layer. The information will be captured utilizing Global Positioning System (GPS) techniques, digitizing from second generation Digital Orthophoto Quadrangles (DOQQ), and/or warping and attributing AHTD centerline files to match the second generation Digital Orthophoto Quadrangles (DOQQ). Address ranges will be stored within the centerline attribute table of the spatial data set.

Status: There are multiple versions of road data maintained by different agencies in Arkansas. The Arkansas State Highway and Transportation Department (AHTD) maintain a Geographic Information System (GIS) with Interstate, U.S. Highway, and State routes. The AHTD uses this system for analysis and segmentation. Additional attributes are maintained in this system such as average daily traffic volumes, accident data, and other road characteristics. The AHTD GIS network is updated biannually.

Also from the AHTD are county maps with state, federal, city and local roads developed from Quad Maps at 1:24,000 that are not attributed at this time. The AHTD Mapping and Graphics Section updates the county maps primarily based on growth of the county or on an as-needed basis (yearly, every five years, etc.). A map of the updates could be supplied if it is in a cyclic cycle of updates (example maps updated every 2 years). Corps of Engineers, USGS, U.S. Forest Service, Arkansas Game and Fish Commission, and local governmental organizations, in particular, cities and counties have transportation related data to offer. Also available is the U.S. Census Bureau Tiger Files that supplies address data for the state.

In Arkansas, state and federal agencies, local governments, utilities, and private industry have made progress in developing transportation (road centerline) GIS data. Primary goals to be achieved include structuring the GIS design so that it can be expanded and enhanced by partners,

while maintaining its consistency and exchangeability; providing for the seamless exchange of GIS data files and the integration of planning infrastructure among all member governments and operating agencies; and expanding the use of GIS among all transportation planning partners and assist all members to improve their capacity as needed to reach a common operational level.

Transportation Spatial Data Layers Available on GeoStor:

Source: United State Bureau of the Census (TIGER)

Miscellaneous Transport 1998
Miscellaneous Transportation 1998
Railroads 1998
Railroads Located 1999
Traffic Analysis Zones 1999

Source: United States Bureau of Transportation Statistics

Airport Runways 1998
Airports 1998
Amtrak Stations 1998
Intermodal Shipping Terminals 1999
Navigable Waterways 1998
Railroads 100K 1998
Railroads 1:2M 1998

Source: United State Geological Survey

Airports (GNIS)
Airports and Landing Strips (DLG)
Canal Locks and Sluice Gates (DLG)
Crevasses (DLG)
Crossings (GNIS)
Dams (DLG)
Falls (DLG)
Ferry Crossings (DLG)
Rail Yards (DLG)
Railroads (DLG)
Trails (DLG)
Bridges (GNIS)

Source: Arkansas Highway and Transportation Department

Airports 2000
Average Daily Traffic Counts 1998
Average Daily Traffic Counts 1999
Boat Docks or Piers 2000
Boat Ramps 2000
Dams with Locks 2000
Weight and Permit Stations 2000

Source: Unknown at this time.

Standards: Many datasets are significantly different despite the fact they may overlap geographically. Statewide standardization is a desirable goal for the transportation theme; however, different standards for different sources of transportation data are probable. The Transportation I-Team members will need to further study and make recommendations for standard metadata, map scale, accuracy, projection, datum and coordinate system standards. Factors to be considered include suitability for linear referencing; dynamic segmentation, network analysis; supporting data and graphical structures; attribution content such as address ranges, sources, and compilation methods; geometric representation of interchanges and ramps, vertical representations and over/underpasses, linear representation of lanes and divided highways; positional accuracy; frequency of updating; and sources of update information.

Priority: The transportation theme is a high priority for the state because the other data themes are dependent upon the completion of this theme. Successful completion of this theme will require the identification, involvement, and active participation of all stakeholders. An in-depth close-up reveals that most agencies, utilities, and companies would be reluctant to abandon transportation datasets in which they have made considerable investment. Alternative approaches to transportation (road centerline) data development would be mandatory to offer transportation data resources within a framework scheme, while retaining the vale of existing data investments. Spatially overlapping datasets would transfer attribute and geometric data between corresponding segments in each of the datasets, which could potentially offer considerable savings when compared to the full costs of data development and/or integration. A statewide transportation data layer that includes street centerlines with accurate addresses would be ideal and beneficial.

Estimated total investment in this theme: Unknown at this time.
Estimated current state and local contributions: Unknown at this time.
What is needed? Unknown at this time.
What is a likely source? Unknown at this time.

Estimated total investment to complete this theme? State and local governments, utilities and private industry have made considerable investments in developing a multitude of transportation datasets in Arkansas. In advancing an NSDI framework data, incorporating existing legacy datasets into a standardized transportation data must take place. Estimated total investment in this theme is about $300,000.

Estimated current allocations of funding? Unknown at this time.
Possible ways to overcome this gap? Unknown at this time.
Most appropriate data steward: Unknown at this time.
Maintenance: Unknown at this time.
Estimated maintenance cost: Unknown at this time.

12.13.1 *Theme:* ARKANSAS CENTERLINE FILE

It is intended that the resulting spatial data layer will be more uniform and horizontally accurate with geocodeable attributes. This will facilitate the sharing of statewide seamless centerline spatial data layer. The information will be captured utilizing GPS techniques, digitizing from second generation DOQQ's, and/or warping and attributing AHTD centerline files to match the second generation DOQQ's. Address ranges will be stored within the centerline attribute table of the spatial data set.

Status: There are multiple versions of road data maintained by different agencies in Arkansas.

The AHTD maintains a Geographic Information System with interstates, United States highway, and state routes. The AHTD uses this system for analysis and segmentation. Additional attributes are maintained in this system such as average daily traffic volumes, accident data, and other road characteristics. The AHTD GIS network is updated biannually.

Also from the AHTD are county maps with state, federal, city and local roads developed from Quad Maps at 1:24,000 that are not attributed at this time. The AHTD Mapping and Graphics Section updates the county maps primarily based on growth of the county or on an as-needed basis (yearly, every five years, etc.). A map of the updates could be supplied if it is in a cyclic cycle of updates (example maps updated every 2 years). United States Army Corps of Engineers, United States Geological Survey, United States Forest Service, Arkansas Game & Fish Commission, local governmental organizations, in particular, cities and counties have transportation related data to offer. The status of the data sources other than the AHTD's is Unknown at this time.. Also available is the United States Census Bureau Tiger Files that supplies address data for the state.

Preliminary work has just begun on the refined Arkansas Centerline File project.

Arkansas Centerlines Spatial Data Layers Available on GeoStor:

Source: Arkansas Highway and Transportation Department 2000

City Streets	City Streets: paved
City Streets: unpaved	County Roads
County Roads: graded	County Roads: gravel
County Roads: paved	County Roads: unimproved
Interstate Highways	Roads: all
Roads: miscellaneous	State Highways: all
State Highways: gravel	State Highways: heavily traveled
United States Highways: all	United States Highways: heavily traveld
United States Highways: lightly traveled	

Source: United States Geological Survey- Digital Line Graph

Interstate Highways (1996) 100K	Local Roads (1996) 100K
Primary Routes (1996) 100K	Roads: all (1996) 100K
Secondary Routes (1996) 100K	State Highways (1996) 100K
United States Highways (1996) 100K	

Source: United States Bureau of the Census (TIGER)

Roads (1998)	Roads (1999)
Roads: all (2000)	Roads: main (2000)

Source: Arkansas Highway & Transportation Department, United States Census Bureau (TIGER) Files, United States Army Corps of Engineers, USGS, United States Forest Service, Arkansas Game & Fish Commission, local governmental organizations, in particular, cities and counties have transportation related data to offer.

Ultimately the source will be the Arkansas State Land Information Board, though the statewide seamless spatial data product will be derived from various sources.

Standards: Arkansas state standards are being created with the input of several federal, state, and local individuals / entities. These standards will define the spatial data layers

accuracy, datum, coordinate system, projection, map scale and metadata (FGDC compliant).

Priority: Secure funding through a broad based partnership, determine and access data that may currently be compliant with the State Standard, and begin to update the spatial data and attributes as needed.

The centerline spatial data layer is a high priority for the state because a number of other spatial data layers are dependent upon its completion. Successful completion of this layer will require the identification, involvement and active participation of all stakeholders.

Estimated total investment in this theme: Unknown at this time.
Estimated current state and local contributions: Unknown at this time.
What is needed? Unknown at this time.
What is a likely source? Unknown at this time.
Estimated total investment to complete this theme? $2,600,000
Estimated current allocations of funding? Unknown at this time.
Possible ways to overcome this gap? Unknown at this time.
Most appropriate data steward: Unknown at this time.

Maintenance: Continual updates will need to be made to the spatial data layer and its attributes.

Estimated maintenance cost: Unknown at this time.

Appendix I- Arkansas State Land Information Board Members

William V. (Bill) Bush

Mr. Bush is State Geologist and Director of the Arkansas Geological Commission (AGC). He is a native of Little Rock and entered state government in 1961 with the Arkansas Highway Department. Mr. Bush joined the staff of the Geological Commission in 1966 after receiving a degree in geology from Arkansas Tech. He has been a staff geologist in various positions from 1966-1985 and served as assistant State Geologist from 1985-1994. Mr. Bush was appointed State Geologist in 1995. Mr. Bush is a UNITED STATES Navy Veteran, a registered Professional Geologist, a Certified Public Manager, and is a member of numerous professional organizations. He serves on the following Boards and Commissions:

- Commissioner on the Arkansas Pollution Control and Ecology Commission
- Member of the Board of Registration for Professional Geologists
- Ex-officio Board member of the Land Survey Division Advisory Board
- Ex-officio member of the Arkansas Geological Commission,
- Member of the Department of Information Systems Steering Committee
- Member of the State Land Information Board.

As Director of the Geological Commission, Mr. Bush is responsible for developing, maintaining and disseminating geologic and mineral resource databases for Arkansas and overseeing the operations of the State Land Survey Division, which includes the Land Records Section and the Remonumentation Program. The Commission uses GIS technology to manage data and to plot geologic and other maps.
In addition to his many years of managing and developing land resource data, Mr. Bush has served on the Governor's State Mapping and Land Records Modernization Advisory Committee that originally recommended the creation of the State Land Information Board.

Chris Boudreaux

Chris Boudreaux is the GIS Coordinator for Conway Corporation, operators of the city-owned electric, electronic, and water systems for the City of Conway. Chris has served as the company's GIS Coordinator since March of 1998. In this capacity, he is charged with development and daily supervision of GIS activities for the Corporation.
Chris has worked with GIS technology since 1990. He has held the following positions:

- GIS Analyst with the Little Rock Wastewater Utility
- Technical Manager for the Pulaski Area Geographic Information System
- GIS Coordinator for Conway Corporation

He is active in the Arkansas GIS Users Forum currently serving as Treasurer. He has served on a multi-agency grant writing committee with the Conway Police Department for federal funding of a crime mapping application. Throughout his ten years has presented several technical papers on the development and use of GIS technologies in the Engineering Utilities sector.

Susan Cromwell

Ms. Cromwell currently serves as Director of Technology Programs for the Fayetteville Public Schools. She served as the Director of the Office of Information Technology from June of 1997 to August of 2001, an office established by the *Arkansas Information Systems Act of 1997*. In this capacity, she was charged with oversight of the following areas to enhance Electronic Government services to the people of Arkansas:

- Shared Technical Architecture
- Agency and Community IT Planning
- State Land Information Coordination
- Technology Investigation.

Ms. Cromwell and staff members in OIT were responsible for advancing IT legislation during the 83rd General Assembly to include the creation of the Executive CIO Office, adoption of acts to guide technology policy (the Uniform Electronic Records Transaction Act [UETA], electronic FOI [open records act]), and to secure appropriations for various programs, including the Office of Geographic Information Systems. As a member of the Interoperability Subcommittee of the National Electronic Commerce Coordinating Council, she helped develop a series of framework documents to guide states in the implementation of security and authentication processes for digital signatures. And, as Co-Chair of the Electronic Records Study Commission, Susan led this legislative study commission in developing the recommendations for amendments to Arkansas's Freedom of Information Act.

Prior to her work with the State, Ms. Cromwell was the Associate Director of Academic, Research, and Client Services at the University of Arkansas in Fayetteville. In addition to managing the system support for academic and research computing on campus, she managed the statewide Network Information Center for the federally funded ARKnet/Internet project. She also provided technical consulting and support for the United Sates Advisory Council for the National Information Infrastructure (NIIAC) in the development of guidelines for on-line intellectual property protection, privacy, and security. And, as a partnership between the University, the community, and the Bank of Fayetteville, Ms. Cromwell and University staff led the development of Aladdin, the first Northwest Arkansas Information Network.

Ms. Cromwell is serving her second term on the State Land Information Board as the chairperson.

Randy Jones

Mr. Jones is GIS Manager of First Electric Cooperative in Jacksonville, Arkansas. He is a 1979 Graduate of the University of Arkansas Fayetteville and in 1980 became a licensed Professional Land Surveyor. Mr. Jones has been an active Member Arkansas Society of Professional Surveyors (ASPS) serving as its President from 1986-87. He was editor of the Society's Quarterly Magazine from 1987-1997. Governor Huckabee appointed Mr. Jones to the State Land Information Board in 1997.

Under Mr. Jones' direction, First Electric Cooperative is in the implementation stage of a project that combines GIS and Engineering design into a seamless facilities management package. The program is arranged into modules for:

- Work Order Tracking
- Engineering Design
- Base Mapping
- As-built Mapping
- Facilities Management
- Outage Reporting

Pole line facilities, customer locations and background data are being captured using G.P.S. Technology. When complete the program will be available to employees across the cooperative's existing network.

W. Fredrick Limp

Dr. Limp is currently Director of the University of Arkansas' Center for Advanced Spatial Technologies (CAST), and is a Professor in the Departments of Anthropology, Geosciences and Environmental Dynamics at the University of Arkansas, Fayetteville. Dr. Limp has been actively involved in research on the technical and methodological aspects of geo-information technologies for more than two decades. He was one of the founders of the Open GIS Consortium (OGC) and continues to serve on its Board of Directors. He was a member of NASA's EOSDIS State Advisors program and serves on SPOT Corporation's Academic Advisors Board. In addition to his scholarly work, Dr. Limp writes extensively on spatial technology issues, including articles and reviews for the professional/technical magazines *GeoWorld, Earth Observing Magazine (EOM), Business Geographics*, (US) *Mapping Awareness* (Britain), *GeoEurope* (Europe) and *GeoAsia* (Asia)

The Center which Dr. Limp directs (CAST) is a multi-college center with a full-time staff of 20 involved in a variety of research and development projects in the arenas of geomatics, geographic information systems, remote sensing, digital photogrammetry, global positioning systems and spatial software interoperability. CAST has been selected as a Center of Excellence by the Oracle Corporation, the Intergraph Corporation, PCI Geomatics, MapInfo Corporation, and the Trimble Navigation Corp. More information on the Center is available on the World Wide Web at www.cast.uark.edu.

Dr. Limp has published six books and more than 100 scholarly articles. He has served as Principal Investigator on grants and contracts totaling more than $18 Million from sources such as NSF, NASA, NPS, DoD, USGS and others. In addition, articles on his work have been featured in popular magazines including *Omni, New Scientist* and *Delta Sky* as well as in National Geographic books, and on US National Public Radio, the Australian Broadcasting Corporation and German Public Television.

He is also actively involved in the political and operational issues related to GIS deployment. He was appointed in 1996 by then Governor Tucker to the Arkansas Mapping and Land Records Modernization Board and served as its Chair.

Mike McGibbony

Mr. McGibbony is the Director of the IT Services Division of the Arkansas Department of Information Systems. Mike brings to state government extensive technology knowledge, business finance skills, and management experience. He has served as President and Chairman of the Board of Information Solutions Group, Inc, of Little Rock; as Chief Information Officer of Dunlap & Kyle, Inc, of Batesville, Mississippi; and as Vice President and Controller of Tipton & Hurst of Little Rock.

Mr. McGibbony graduated from the University of Arkansas at Little Rock in 1986, and did undergraduate study at UALR in Liberal Arts and Computer Science in 1986-1987. He holds Novell CNE Certification.

As Director of the IT Services Division of DIS, he is in charge of developing a statewide information resource infrastructure that unites public and private entities. The IT Services Division is also responsible for the implementation, support, improvement, and reliable operation of DIS mission-critical activities and systems. A partial list of these systems includes State Government's phone system, the shared statewide data network, and the DIS Data Center.

Shirley Sandlin

Ms. Sandlin is the county Assessor of Benton County. She is a native of Arkansas and has been married to Mr. Jack Sandlin for 39 years. She is a mother of four children – Sherry Sandlin Treat, Brian, Gregory, & Allen Sandlin and proud Grandmother of four.

Ms. Sandlin was first elected Assessor of Benton County in 1987. She began working toward digital mapping & began cyclical revaluation of all real property in county 1989. She implemented a computer-assisted mass appraisal package in 1990 with a goal to integrate to GIS. This work is now in progress. She retains membership and serves in the following organizations:

- United Way since 1990 and served on Board of directors through 1996
- Arkansas Assessor's Association
- International Association of Assessing Officers (IAAO)
- Level IV property appraiser, Arkansas Chapter F IAAO (chosen Assessor of the year 1994-1995)

Earl T. Smith, Jr., P.E.

Mr. Smith is Chief of the Water Resources Management Division of the Arkansas Soil and Water Conservation Commission. He graduated from the University of Arkansas, Fayetteville, in 1973 with a Master of Science Degree in Environmental Engineering. He is a member and Past President, Arkansas Section, of the American Society of Civil Engineers, and a member of the National Society of Professional Engineers.

During his career at ASWCC, he has had supervisory oversight of personnel in fulfilling the Commission's responsibility as the State's lead agency in nonpoint source pollution management. He has served in an advisory capacity to the Governor's Animal Waste Task Force. He has provided key staff support in the development and adoption of Rules and Regulations for Utilization of Surface Water; Rules for Utilization of Ground Water; Rules for Water Development Project Compliance with the Arkansas Water Plan; Rules and Regulations Governing the Tax Credit Program for the Creation and Restoration of Private Wetland and Riparian Zones, and Rules Governing the Arkansas Wetlands Mitigation Bank Program.

Mr. Smith has chaired the White River Ad Hoc Work Group, which is a Committee formed by the Army Corps of Engineers to provide recommendations on a revised operation plan for the White River Lakes; and he chaired the White River Dissolved Oxygen Committee originally formed by former Governor Bill Clinton.

Jubal Smith

Mr. Jubal Smith joined Entergy’s office of Economic Development on September 8, 1997 and currently serves as Project Manager for Entergy Arkansas. Prior to becoming Project Manager, Mr. Smith served as Manager of Entergy’s Community Resource Center.

As Project Manager for Entergy Arkansas’ Economic Development Department, Mr. Smith's goals are to recruit business and industry to Arkansas and aid in expansion efforts of business and industry currently located in Arkansas. He also works with state and community officials in Economic Development processes and practices.

Mr. Smith came to Arkansas from Hattiesburg, Mississippi. He earned his Master of Science Degree in Economic Development from the University of Southern Mississippi and his bachelor’s degree from Mississippi State University.

Prior to working with Teamwork Arkansas, he worked for the Mississippi Department of Economic & Community Development and the Southeast Mississippi Economic Development Network.

Mr. Smith is a member of the American Economic Development Council (AEDC), the Southern Economic Development Council (SEDC), and Arkansas Economic Developers (AED). He is a certified Economic Development Finance Professional.

As a member of the Arkansas State Land Information Board, Mr. Smith works to improve the quality, access, and cost effectiveness of geographic information across Arkansas. He specifically uses GIS applications for Economic Development related projects, which include business attraction and retention, industrial park development, and community development.

Phyllis Smith

Ms. Phyllis Smith is Assistant Director of the State Data Center and Manager of the Geographic Information System (GIS) Applications Laboratory, Institute for Economic Advancement, at the University of Arkansas at Little Rock

Ms. Smith, an Associate Research Specialist for the University of Arkansas at Little Rock, has worked with census data since 1971. In 1994 she was invited to Geneva, Switzerland, for four months to analyze censuses for the United Nations' Economic Commission and has continued to serve as a consultant to the UN for two years after returning to Arkansas.

Ms. Smith has been working with GIS technology since 1990. She was a member of the Executive Committee that formed the Arkansas GIS Users Forum and has been an officer of the Forum for eight years, currently serving as the Chair. Ms. Smith served on Governor Tucker's Health Care Reform Task Force. Governor Mike Huckabee appointed Ms. Smith to the AR State Land Information Board in 1999.

Jim Wells

Mr. Wells is Vice President of Wellsco Inc. He is a co-founder of the EAST initiative and currently serves as the lead Private Sector Partner. Mr. Wells moved to Paragould, AR in May of 1993 to join the family's Telecommunications Engineering Services firm, Wellsco, Inc., which serves clientele such as GTE, Southwestern Bell, AT&T, Sprint and Valor Telecommunications Southwest. In late 1994, Mr. Wells accepted responsibility for the creation of Wellsco Graphic Solutions, which represents developers and manufacturers of Advanced Applications technologies.

Before his relocation to Arkansas from Houston, Mr. Wells served as a Senior Asset Manager in the Commercial Real Estate industry with Weingarten Realty, Transwestern Property Company, and the Lewis Companies. In this capacity Mr. Wells' primary area of focus was the repositioning of underperforming and distressed assets for institutional and private clientele. Prior to his involvement in commercial Real Estate, Mr. Wells directed the creation of Browning Ferris Industries Houston Medical Waste Operations, and participated in the initial startup of Pioneer Concrete of America's entry into the Texas market.

Mr. Wells became involved with sponsoring the EAST Initiative after having directed substantial growth and expansion at Wellsco, Inc., where the firm experienced firsthand the shortages in the state workforce of employees who are well equipped to contribute in an Information Technology (IT) environment.

Suzanne Wiley

Suzanne Wiley is currently a GIS Applications Specialist with the Environmental and Natural Resources Section of the University of Arkansas Cooperative Extension Service. She is stationed at the School of Forest Resources, University of Arkansas-Monticello. Her background is in biology, agriculture and forestry research. She has a MS degree in Biology from Texas Tech University.

Ms. Wiley has been active in geographic information systems (GIS) technologies for almost a decade. She participated in the first GIS short-course taught at the National Center for Resource Innovations/Center for Advanced Spatial Technologies (CAST), University of Arkansas-Fayetteville in 1991, and began attending Arkansas GIS Users Forum Conferences in 1992. Ms. Wiley served as Technical Analyst in the Spatial Analysis Laboratory of the School of Forest Resources, University of Arkansas-Monticello for 6 years, and has been involved in forestry research as a member of the professional staff since 1987.

Between 1991 and 1994, she played an active role in the initial development of the GIS laboratory at the School of Forest Resources, UAM, and served a term as Chair of the GIS Committee. This lab has now developed into the state-of-the-art Spatial Analysis Laboratory under the direction of Dr. Robert Weih. Ms. Wiley assisted with research projects in GIS, remote sensing, and global positioning systems (GPS).

Ms. Wiley served on the Board of Advisors for the National Center for Resource Innovations, Southwest, in 1993 and 1994. In 1994 Governor Jim Guy Tucker appointed her to the State Mapping and Land Records Modernization Advisory Board under the provisions of Act 150. She also served as liaison between the High Accuracy Reference Network Technical Committee and the Act 150 Board in 1994. She is currently serving her second term on this board.

Appendix II- Arkansas Geographic Information Office Staff

Shelby Johnson, State Geographic Information Coordinator

Shelby D. Johnson received a B.A. in Geography from the University of Arkansas. He spent seven years doing G I S research and working as the community outreach contact for the Center for Advanced Spatial Technologies (CAST) a nationally recognized spatial research organization. Shelby served as Chair of the Arkansas G I S Users Forum in 1996 and 1997 and was instrumental in organizing the State Land Information Board. In 1998 he was appointed to the State Land Information Board by Governor Huckabee and in early 1999 was selected as the State Land Information Coordinator by the Department of Information Systems. Act 1250 of 2001 changed his title to State Geographic Information Coordinator. Shelby currently serves on the National States Geographic Information Council (NSGIC) Board.

The Mid-America G I S Consortium honored Shelby with an Individual Achievement Award for advancing geographic information technology. In his role as the State Geographic Information Coordinator he is responsible for assisting the State Land Information Board in building a coordinated G I S system to meet the needs of the people of Arkansas.

Learon Dalby, G I S Program Manager

Learon Dalby received his B.S. degree in biology, from the University of Arkansas at Little Rock. He spent three years doing G I S research and working as the Arkansas Hazards Mitigation and Project Impact contact for the University of Arkansas at Little Rock G I S Applications Laboratory. While serving in this role he worked with the State Office of Emergency Services and other state agencies to provide the G I S component of the state Hazards Mitigation plan. His work with Project Impact included coordinating with select communities to develop the G I S applications associated with their plans.

In the summer of 2000 the Department of Information Systems hired Learon as the G I S Program Manager where he now works under the direction of Shelby Johnson, the State Geographic Information Coordinator of the State of Arkansas. In his role as the G I S Program Manager he is responsible for providing direction on G I S projects and programs, cooperative data development projects, assists with web-page development and coordination with data development with stakeholders.

Appendix III- Arkansas I-Team Subcommittee Members

2.1 Cadastral

Name	*Title*	*Organization*
Chairperson- Shirley Sandlin	County Assessor	Benton County Arkansas
Debbie Asbury	Director	Arkansas Assessment Coordination
Farrell Adams	Photogrammetry, Section Head	Arkansas Highway & Transportation Department
Chuck Baclaski	Director	Pulaski Area Geographic Information Systems
Jeff Barnes	Parcel Consultant	ProMap
Adrian Clark	President	Devereaux & Associates
Tracy Conn,	Parcel Consultant	ProMap
Ed Crane	GIS Consultant	ESRI
Paul Edwards	Section Head, Mapping & Graphics	Arkansas Highway & Transportation Department
Russell Gibson	GIS Specialist	City of Fort Smith Arkansas
Rick Johnston	Mapping Supervisor	Pulaski County Assessor's Office
Robert Laman	Mapping Supervisor	Arkansas State Building Services
Mike Mitchell	GIS Consultant	Devereaux & Associates
Kathy Nix	County Assessor	Sharp County Arkansas
Cathy Pearson	County Assessor	Cleburne County Arkansas
James Perry	County Assessor	Sebastian County Arkansas
Tammy Sanders	County Assessor	Izard County
Linda Sparrow	County Assessor	Lafayette County
John Zimple		Arkansas Coordination Department

2.2 Census

Chairperson- Phyllis Smith	Assistant Director	Census State Data Center
Steve Alexander	Administrative Officer III	Arkansas Highway & Transportation Department
Dr. Paul Medley	Assistant Professor of Spatial Information Systems and GIS	University of Arkansas at Monticello
David Rasmussen	Research Analyst	Demographic Research, UALR

2.3 Centerlines

Chairperson- Christine Crawford	GIS Specialist	Arkansas One Call
Sharon Baker	GIS Specialist	Arkansas Highway & Transportation Department Mapping Division
Chris Boudreaux	GIS Coordinator	Conway Corporation

Kit Carson	Division Head	Arkansas Highway & Transportation Department Surveys Division
Teresa Cline	Network Specialist	Central Arkansas Planning Development District
Dale Enoch	Director	Arkansas One Call
Paul Edwards	Section Head	Arkansas Highway & Transportation Department Mapping and Graphics
Randy Everett	GIS Supervisor	North Arkansas Electric Cooperative
Wes Flack	Geographer	United States Census Bureau
Robert Fuhler	Cartographer	Arkansas Highway & Transportation Department Environmental Division
Randy Fusaro	Chief	United States Census Bureau TIGER Operations Branch
Randy Jones	Distribution Manger	First Electric Cooperative
Carl Lindstrom	Civil Engineer VI	Arkansas Highway & Transportation Department
Tim Mahan	Cartographer	Arkansas Highway & Transportation Department Planning and Research
Rusty Myers	Assistant Executive Director	Western Arkansas Planning and Development District
Bill Richardson	Assistant Division Head	Arkansas Highway & Transportation Department Environmental Division
Todd Schroeder	Surveyor	First Electric Cooperative
Conya Spencer	Community Services Specialist	Central Arkansas Planning Development District
Tina Thompson	GIS Manager	Western Arkansas Planning and Development District

2.4 Critical Infrastructure

Chairperson- Susan Cromwell	IT Director of Fayetteville	Arkansas School District
Randy Jones	Distribution Manger	First Electric Cooperative
Garland Land	Heavy Bridge Maintenance Engineer	Arkansas Highway & Transportation Department
Mike Mitchell	GIS Consultant	Devereaux & Associates

2.5 Digital Orthophotography

Chairperson- Earl Smith	Chief of Water Resources Management Division	Arkansas Soil and Water Conservation Commission
Farrell Adams	Photogrammetry, Section Head	Arkansas Highway &

		Transportation Department
Kit Carson	Division Head	Arkansas Highway & Transportation Department Surveys Division
Mike Mitchell	GIS Consultant	Devereaux & Associates
Joe Bob Penor	Remote Sensing Education Specialist	Leica Geosystems - GIS & Mapping Division; ERDAS Inc
Phillip Rye	Civil Engineer III	Arkansas Highway & Transportation Department
Bob Weih	Director	Spatial Analysis Laboratory University of Arkansas at Monticello

2.6 Elevation		
Chairperson- Tony Hill	GIS Coordinator	United States Army Corps. of Engineers \ Little Rock District
Kit Carson	Division Head	Arkansas Highway & Transportation Department Surveys Division
Mike Daniels	Agricultural Specialist	Arkansas Cooperative Extension Office
Carl Lindstrom	Civil Engineer VI	Arkansas Highway & Transportation Department
Tracy Ford Moy	GIS Coordinator	Arkansas Game & Fish Commission
Joe Bob Penor	Remote Sensing Education Specialist	Leica Geosystems - GIS & Mapping Division; ERDAS Inc
Bob Weih	Director	Spatial Analysis Laboratory University of Arkansas at Monticello
Dean Wilkerson	Staff Surveys Engineer	Arkansas Highway & Transportation Department

2.7 Geodetic Control		
Chairperson- Mike Garner	Director of Geospatial Information System	University of Arkansas - Fort Smith, Fort Smith, Arkansas
Chris Boudreaux	GIS Coordinator	Conway Corporation
Everett Rowland	Arkansas State Land Surveyor	Arkansas State Land Commissioners Office
Joe Bob Penor	Remote Sensing Education Specialist	Leica Geosystems - GIS & Mapping Division; ERDAS Inc
Kit Carson	Division Head	Arkansas Highway & Transportation Department Surveys Division
Mickie Warwick	President	Arkansas Society of Professional

		Surveyors
Russell Gibson	GIS Specialist	City of Fort Smith Arkansas
Steve Corley		Corps. of Engineers
Tom Webb	Surveyor	McGoodwin, Williams, & Yates
Dean Wilkerson	Staff Surveys Engineer	Arkansas Highway & Transportation

2.8 Geology		
Chairperson- Doug Hanson	GIS Specialist	Arkansas Geologic Commission
Bill Bush	Director	Arkansas Geologic Commission
Brian Clark	GIS Specialist	US Geological Survey
Steven Hill	GIS Specialist	Arkansas Department of Health
Robert Fuhler,	GIS Coordinator	Department

2.9 Governmental Units		
Chairperson- Tim Humphries	General Council	Arkansas Secretary of State
Susan Cromwell	IT Director of Fayetteville	Arkansas School District
Steve Alexander	Administrative Officer III	Arkansas Highway & Transportation Department
Randy Everett	GIS Supervisor	North Arkansas Electric Cooperative
Shirley Sandlin	County Assessor	Benton County Arkansas
Phyllis Smith	Assistant Director	Census State Data Center

2.10 Hydrography		
Chairperson- Dr. Paul Medley	Assistant Professor of Spatial Information Systems and GIS	University of Arkansas at Monticello
Brooks Booher	Staff Hydraulic Engineer	Arkansas Highway & Transportation Department
Pam Cooper	GIS Specialist	United States Natural Resources Conservation Service
Mike Daniels	Agricultural Specialist	Arkansas Cooperative Extension
Tracy Ford Moy	GIS Coordinator	Arkansas Game and Fish Commission
Doug Hanson	GIS Specialist	Arkansas Geologic Commission

2.11 Land Use / Land Cover		
Chairperson- Tracy Ford Moy	GIS Coordinator	Arkansas Game and Fish Commission
Bruce Gorham	Remote Sensing Specialist	Center for Advanced Spatial Technologies
Steven Hill	GIS Specialist	Arkansas Department of Health
Mike McGibbony	Director of the IT Services	Arkansas Department of

	Division	Information Systems
Joe Bob Penor	Remote Sensing Education Specialist	Leica Geosystems - GIS & Mapping Division; ERDAS Inc
Earl Smith	Chief of Water Resources Management Division	Arkansas Soil and Water Conservation Commission
Phillip Moore	Environmental Scientist	Arkansas Highway & Transportation Department

	2.12 Public Land Survey System (PLSS)	
Chairperson- Mickie Warwick	President	Arkansas Society of Professional Surveyors
Everette Rowland	Everett Rowland	Arkansas State Land Commissioners Office
Joe Clements	Executive Director	Board of Registration Professional Engineers and Land Surveyors
Jan Emerson	GIS Specialist	Ouachita National Forest
Russell Gibson	GIS Specialist	City of Fort Smith Arkansas
Tammy Hocutt	GIS Coordinator	Ozark National Forest
Randy Jones	Distribution Manger	First Electric Cooperative
Kit Carson	Division Head	Arkansas Highway & Transportation Department Surveys Division
Hal Humerickhouse	Surveyor	Ozark National Forest
Tina Rotenbury	GIS Specialist	Ozark National Forest
Earl Smith	Chief of Water Resources Management Division	Arkansas Soil and Water Conservation Commission
Jim Tadel	Surveys Specialist	Arkansas Highway & Transportation Department
Tom Webb	Surveyor	McGoodwin, Williams, & Yates
George West	Staff Sr. Land Surveyor	Arkansas Highway & Transportation Department

	2.13 Soils	
Chairperson- Pam Cooper	GIS Specialist	Natural Resource Conservation Service
Steven Hill	GIS Specialist	Arkansas Department of Health
Jon Annable,	Geotechnical, Section Head	Arkansas Highway & Transportation Department
Deano Traywick	GIS Specialist	Natural Resource Conservation Service
Mike Daniels	Agricultural Specialist	Arkansas Cooperative Extension

2.14 Telecommunications		
Chair- Susan Cromwell	IT Director of Fayetteville	Arkansas School District
Mike McGibbony	Director of the IT Services Division	Arkansas Department of Information Systems
Randy Everett	GIS Supervisor	North Arkansas Electric Cooperative

2.15 Transportation		
Co-chair- Bryan Stewart	Computer Technical Coordinator	Arkansas Highway & Transportation Department
Co-chair- Dorothy Rhodes	Advanced Research Study Engineer	Arkansas Highway & Transportation Department
Gary Dalporto	Planning Engineer	Department of Transportation
Minh Le	Planning Engineer	MetroPlan
Randall Looney	GIS Specialist	Department of Transportation
Margarett Sithong	Applications Analyst/Programmer	Arkansas Highway & Transportation Department